ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

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HEARINGS

BEFORE A

SUBCOMMITTEE OF THE COMMITTEE ON GOVERNMENT OPERATIONS HOUSE OF REPRESENTATIVES

EIGHTY-THIRD CONGRESS

SECOND SESSION

JUNE 8, 9, 10, 11, 14, 15, 16, 17, 18, 22, 23, AND 24, 1954

Printed for the use of the
Committee on Government Operations

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[1] Hon. John W. McCormack of Massachusetts participated in these hearings.

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ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

TUESDAY, JUNE 8, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON MILITARY OPERATIONS
OF THE COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met at 10 a. m. in room G–53, United States Capitol, Hon. R. Walter Riehlman (chairman of the subcommittee) presiding.

(Members present: R. Walter Riehlman, Glenard P. Lipscomb, John W. McCormack, Bill Lantaff, and Frank Ikard.)

(Also present: Michael P. Balwan, staff director; Paul J. Cotter, chief counsel; Robert Morris, counsel; James Eckhart, legal assistant; Walter Whitver, staff member; Carey Brewer, Legislative Reference Service; and Murray Jackson, representing Mr. Hoffman of Michigan.)

Mr. RIEHLMAN. The subcommittee will come to order, please.

It is my understanding that 1 or 2 other members are on the way. I will proceed to read into the record the statement which I have prepared with respect to this hearing.

Before I do that I would like the record to show that the members who are present are Mr. Riehlman, Mr. Lipscomb, Mr. Ikard, and Mr. Lantaff. I would also like the record to show that we are delighted to have with us this morning the Honorable John McCormack, who has been very much interested in this program throughout the years. We have invited him, as a member of the full committee, to sit in through these hearings.

Mr. McCormack, may I express to you our sincere hope that you will lend your aid in these hearings, because of your past interest and your desire to do something very helpful in this field of research and development.

Mr. MCCORMACK. Thank you, Mr. Chairman. I appreciate the invitation to sit in, and to the extent I can I will try to make my constructive contribution.

Mr. RIEHLMAN. I am sure you will.

This meeting, of course, is held in executive session. I think it would be proper to put into the record a very brief statement which I have to make as chairman.

I do not have to call to your attention, gentlemen, that each day's news reminds the people of the United States that our military power in the world political scene is inseparably related to our ability to maintain superiority in scientific research and development. Our human resources in the field of science are a precious commodity which must be husbanded.

NOTE.—Asterisks denote classified material deleted.

This subcommittee's interest in the Department of Defense program for research and development is not based on any isolated recent development. The subcommittee expressed its desire to look into this field when the subcommittee's program was approved by the Congress last year, and again this year.

This subcommittee's inquiry into military research and development programs stems from several questions concerning the organization and administration of the program in the Department of Defense. The subcommittee has provided the representatives of the Department of Defense with a list of these questions which I shall insert at this point in the record, rather than to take the time to read them. These questions were also sent to about 50 of the Nation's leading scientists and scientific administrators for their comment in order that the subcommittee might receive the benefit of their informed opinion.

With the permission of the subcommittee I would like to insert those questions we have sent out at this point in the record. If there is no objection it will be so ordered.

(The information is as follows:)

QUESTIONS UNDER CONSIDERATION BY THE SUBCOMMITTEE

1. Are there any characteristics inherent in military organization which are incompatible with the administration of an effective program of scientific research and development?

2. Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?

3. Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?

4. Would it be feasible to organize military research and development programs in such a way that the technical activities capable of being performed by a civilian organization could be separated from those which are purely military, such as support functions? Where military support activities are necessary in connection with a research and development project, and such activities must be under a military commander, does it necessarily follow that the technical research and development functions must also be under direct military supervision?

5. To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs? To what extent should private, nonprofit institutions participate? To what extent should private industry participate? How much in-house research is required for the military services to be capable of exercising qualitative control over research and development conducted by outside laboratories?

Mr. RIEHLMAN. During the course of the subcommittee's investigation of several specific military research and development centers, it appeared that the program was plagued with several problems. The subcommittee has formed no conclusions at this time concerning the validity of these reported problems. It does have some evidence that these problems have some factual basis in certain military research operations, and it intends to hear testimony from selected witnesses. The subcommittee sincerely presents the reported problems as a series of working hypotheses, and we hope that the presentation by top officials from the Department of Defense can aid the subcommittee in evaluating these hypotheses and formulating informed, constructive conclusions.

Since a list of these problems has been provided for your information, I wish to insert them into the record at this point rather than

to read them. I believe the phrasing of the reported problems has been slightly changed, and revised copies will be distributed to you at this time.

I am sure that the members have read these different questions, but I think it might be well to read a few of them. The Secretary has had them presented to him, I think, and has answered all of them in his statement this morning.

Have the members had an opportunity to read these different questions?

Mr. IKARD. I have, Mr. Chairman.

Mr. RIEHLMAN. I think it will be unnecessary to read them at this time. I will ask that they be inserted in the record at this point.

(The information is as follows:)

REPORTED PROBLEMS IN MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

I. Civilian scientists in military research and development centers are reported to be generally dissatisfied with military domination and administration.

II. Civilian scientists are leaving military research and development centers.

III. When a military organization is imposed on a research and development program there is a tendency for the military to expand its control over technical decisions and operations in the research laboratories.

IV. With a few notable exceptions, military research and development officers are not scientists who command the respect of the civilian scientists.

V. The policy of rotating assignments for military officers militates against the retention of officers who in some cases have the training, talents, and disposition to guide scientific research centers.

VI. Research centers often are organized and administered as military organizations with the attendant restrictive forms, procedures, regulations, and military discipline which do not provide the optimum climate for research work by civilian scientists.

VII. The lack of either a definite or consistent policy for organizing and adminstering research and development centers leaves each center at the mercy of each change in commanding officer and Executive. This creates an instability with no assurance that even the well-run research and development center will not become, with a change of officers, an unbearable situation.

VIII. Several outstanding civilian scientists who have been associated with military research and development programs are reported to be in favor of changes in the governmental organization and administration of these programs.

IX. The funding of research and development is confused when handled with military budgets. Direct research and development costs are justified to and appropriated by the Congress as such. However, this does not give a true picture of the actual total cost of military research and development programs inasmuch as there are substantial indirect costs arising from military support functions in the form of pay for uniformed officers, provision of capital facilities, and certain maintenance and operation expenditures.

In this connection, it is reported that it is often felt necessary to build up a research and development center with such support functions in order to make it "respectable" in terms of size and complexity as a command for a colonel or general. This, in turn, sets off a vicious cycle in that the existence of military support elements becomes a further excuse for military domination, more officers, regulations, etc.

Mr. RIEHLMAN. Basically, the purpose of the subcommittee hearing is to determine whether the Nation's scientific human resources are being utilized to an optimum degree in carrying out our military preparedness program. As a military operations subcommittee, it is proper for us to be concerned with the organization and administration of this program.

The hearings will be divided into three parts.

The first part will be a briefing by Department of Defense top policy officials. The subcommittee has asked the Assistant Secretary

of Defense for Research and Development, the Honorable Donald Quarles, to describe the operations of his office and to explain the scope of the research and development program from his level in the Department of Defense. His presentation will be followed by briefings from representatives of the Army, the Navy and the Air Force.

I understand that your staff and the subcommittee staff have explained to you what areas the subcommittee will want to cover. I think that is true, is it not, Mr. Secretary?

Mr. QUARLES. Yes, sir.

Mr. RIEHLMAN. At this point I will insert in the record a copy of the subcommittee's letter to you which requests your presence and which provides you with an outline of our inquiry.

(The information is as follows:)

JUNE 1, 1954.

Hon. DONALD A. QUARLES,
Assistant Secretary (Research and Development),
Department of Defense, Washington 25, D. C.

DEAR MR. SECRETARY: During the past month this subcommittee has undertaken a survey of the Department of Defense research and development program. You will recall that this study was initiated partially by our inquiry into the guided-missile program. However, this subcommittee project is not specifically limited to the guided-missile program, but rather is intended to explore the entire field. As a result of initial inquiries, the subcommittee's attention has been called to certain problems in the administration of this program, and has decided to schedule hearings during the week of June 7, 1954.

The subcommittee would like very much to be briefed by you on the overall organization and administration of the research and development program from the level of the Office of the Secretary of Defense. We should like to schedule this for Tuesday, June 8, 1954, at 10 a. m., in room G–53 of the Capitol. We are planning to have representatives of the Army, the Navy, and the Air Force follow you on a more detailed presentation of their research and development programs in the service departments.

The subcommittee staff has been instructed to contact you in order to explain the details of the hearing and to answer any questions you might have concerning it.

For your convenience and information there are enclosed (1) a list of questions typical of but not necessarily exhausting the issues of particular interest to the subcommittee and (2) a list of reported problems dealing with research and development which have been brought to the subcommittee's attention. These may assist you in getting an idea of the kinds of information the subcommittee would like to get from these hearings. In addition, we hope that the briefing will include information touching on the following points:

1. The scope of Department of Defense research and development program.
2. The extent of coordination of all the technical service research and development programs at the levels of the Chief of Staff and the Secretary.
3. Organization charts which illustrate lines of responsibility and authority.
4. Any contemplated changes in the organization and administration of this program.
5. The direct costs of the Department of Defense research and development program for fiscal years 1953, 1954, and 1955.
6. An estimate of the indirect costs allocable to these programs to the extent that this is feasible.
7. Your reactions to the reported problems and issues set forth in the enclosures.

The subcommittee invites the Department of Defense to present a prepared statement covering these points and would appreciate receiving copies of this statement at least 24 hours in advance of the hearing date.

Please be assured that this subcommittee will be very happy to keep you advised of any developments in which you might have an interest.

Sincerely yours,

R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee.

Mr. RIEHLMAN. The second part of our hearing will deal with several selected military research and development centers. Although the subcommittee does not wish to imply that these examples comprise a representative sampling of the situation which obtains at the operating levels of the program, it hopes to be able to examine certain common problems which appear to be critical at this time.

The third part of our hearings will consist of testimony from several selected scientists with national reputations, who, in many cases, have been closely associated with the Department of Defense program for research and development. The subcommittee has canvassed about 50 scientists for their opinions. At this time I would like to insert into the record a copy of the subcommittee's letter to these leading scientists, together with a list of those scientists to whom the letters were sent. I hope that when the replies come in we shall be able to insert their comments as a part of the record to be developed.

Is there any objection to that? If not it will be so ordered.

(The information is as follows:)

MAY 27, 1954.

During the past few weeks the Military Operations Subcommittee has been conducting an inquiry into the operation of various scientific research and development programs in the Department of Defense. The subcommittee staff has already contacted a few individuals who have given us their views on these programs and suggestions for improvement, and some who have pointed up particular shortcomings.

Because of the important role that research and development plays in our national-defense program, and because of the large appropriations which are involved, the subcommittee is interested in obtaining the views of many scientists and administrators who might be able to assist the inquiry.

In view of your background and interest in scientific research and development, we are especially anxious to have the benefit of your experience.

The following represent the types of questions which are facing the subcommittee, but this is not meant to be an exhaustive list:

1. Are there any characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development?

2. Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?

3. Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?

4. Would it be feasible to organize military research and development programs in such a way that the technical activities capable of being performed by a civilian organization could be separated from those which are purely military, such as support functions? Where military support activities are necessary in connection with a research and development project, and such activities must be under a military commander, does it necessarily follow that the technical research and development functions must also be under direct military supervision?

5. To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs? To what extent should private, nonprofit institutions participate? To what extent should private industry participate? How much "in-house" research is required for the military services to be capable of exercising qualitative control over research and development conducted by outside laboratories?

The subcommittee is considering the possibility of holding hearings in about 2 weeks. If you have some views on these questions, or if you have any suggestions for improving the present organization for military research and development, we would appreciate a written statement from you. Please be assured there is no obligation on your part to appear personally, although the subcommittee may wish you to do so if you are willing.

Because this is by no means a modest request, we should be happy to have one of our staff members meet you at some convenient location to discuss this problem with you personally, or if you are going to be in Washington in the near future, perhaps you could meet with us at the subcommittee offices or at any other convenient place.

Sincerely yours,

R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee.

(A list of those individuals to whom letters were sent, together with their replies, is included in the appendix.)

Mr. RIEHLMAN. Now, Mr. Secretary, may I say to you: We are delighted to have you up here this morning. I have had the privilege of reading your statement. I told you that I got up rather early this morning to read it through very carefully. I am not going to comment on it at this time, but we will be very delighted to hear from you at this time, sir.

STATEMENT OF HON. DONALD A. QUARLES, ASSISTANT SECRETARY OF DEFENSE (RESEARCH AND DEVELOPMENT)

Mr. QUARLES. Thank you very much, Mr. Chairman and gentlemen. I appreciate very much your inviting me to be here and the opportunity to come before you and discuss our research and development program in defense, and particularly the aspects of the program which you have pointed up in your letter to me and in the reported problems or questions which you have specifically directed to us.

May I say to you, gentlemen, that the chairman's remarks about the importance of research and development programs and about mustering science and technology to the defense of the country are taken very seriously by us. We are very glad, indeed, to see this evidence of your keen appreciation of this problem.

Mr. RIEHLMAN. Thank you, sir.

Mr. QUARLES. Since this is my first appearance before this subcommittee, I believe it will be helpful to give a brief statement of my background and experience. I was born in Van Buren, Ark., in 1894. After graduation from the high school there, I attended the University of Missouri and then Yale University where I received a bachelor of arts degree. In May 1917, I enlisted in the Army and, after 2 years in France and Germany, was discharged with the rank of captain in field artillery. Upon my return to civilian life in 1919, I was employed by the Western Electric Co. in New York City in the engineering department which became the Bell Telephone Laboratories in 1925. While there, I took some graduate work at Columbia University in theoretical physics. I served the Western Electric Co. and the Bell Telephone Laboratories for 34 years at various engineering and executive positions, becoming vice president of the Bell Telephone Laboratories in 1948. I served in that capacity until March 1, 1952, when I became vice president of Western Electric Co. and president of the Sandia Corp., a Western Electric subsidiary which operates the Sandia Laboratory in Albuquerque, N. Mex., for the Atomic Energy Commission.

In addition to the military and industrial experience, I have served as a consultant to the Government on research and development activities since 1946. In that year, I was appointed a member of the Electronics Committee of the Research and Development Board. I

was Chairman of this Committee from 1949 until the termination of the Research and Development Board last year. I resigned as vice president of Western Electric Co. and president of the Sandia Corp. on September 1, 1953, in order to take the position of Assistant Secretary of Defense (Research and Development).

In briefing you this morning, I plan to use as an outline the 20 subjects, questions, and problems, mentioned in the chairman's letter to me of June 1. I will, of course, be happy to answer any other questions which you may care to ask.

SCOPE OF DEPARTMENT OF DEFENSE RESEARCH AND DEVELOPMENT

The Department of Defense research and development program, which includes the programs of the Army, Navy, and Air Force, is a large one. At present it includes more than 8,000 individual projects. It is estimated that more than one-half of the Nation's reserach engineers and scientists are working on the programs of the Department of Defense and the related programs of the Atomic Energy Commission. Approximately 67 percent of the defense research and development dollar (direct cost) is spent by contract with outside organizations and 33 percent is spent within Government establishments. Universities and nonprofit institutions assist the Department of Defense is conducting basic and applied research oriented toward military requirements and industrial laboratories and organizations work on the developmental phases of weapons development and improvement.

Every field of technical knowledge is explored to find new techniques, new methods and new weapons to keep the Army, Navy, and Air Force ahead of any potential enemy. Some of the technical fields covered will be made clearer when I discuss the organization within the Department of Defense for the coordination of research and development programs.

In order to give you a better idea of the nature of the Department of Defense program I might just mention some of its accomplishments in weapons development and one of our more urgent defense problems. The Army is introducing a whole family of new weapons for use on the battlefield, all capable of delivering atomic fire. A 280-millimeter gun is already in Europe which can pinpoint targets at 20 miles. For antiaircraft defenses the NIKE guided missile is in production and in the hands of the troops. The Navy is converting two heavy cruisers, the *Boston* and the *Canberra*, into guided-missiles ships, and is modifying the submarine *Tunny* so that it can launch the surface-to-surface guided missile Regulus, which has been successfully tested for use by ships. Last January, the first atomic-powered submarine was launched, the *Nautilus;* it is now being fitted out. A second one is currently under construction.

The Air Force has the 10-engined B–36 heavy bomber and the new 6-jet B–47 medium bomber, which are the fastest operational bombers known to us today. Last summer, the new 8-jet B–52 heavy bomber was demonstrated. The Air Force has primary responsibility for the radar network and interceptors which, together with the Army's local antiaircraft artillery and missiles, make up our continental defense system. A very substantial development program is in

progress in the continental defense field in recognition of the fact that there are technical deficiencies in the way of achieving an airtight defense.

EXTENT OF COORDINATION AND ORGANIZATION CHARTS

Representatives of the Army, Navy, and Air Force who will follow me will make a more detailed presentation of the coordination of the technical service research and development programs at the higher levels of their Departments. I shall confine my remarks to the coordination among the three Departments at the level of the Office of the Secretary of Defense.

On April 30, 1953, the President transmitted Reorganization Plan No. 6, recommending a number of changes in the Department of Defense, which plan became effective June 30, 1953. The Office of the Secretary of Defense is organized in accordance with the reorganization plan. The organization chart (fig. 1) shows how the Office of the Secretary of Defense is organized.

(Fig. 1 is as follows:)

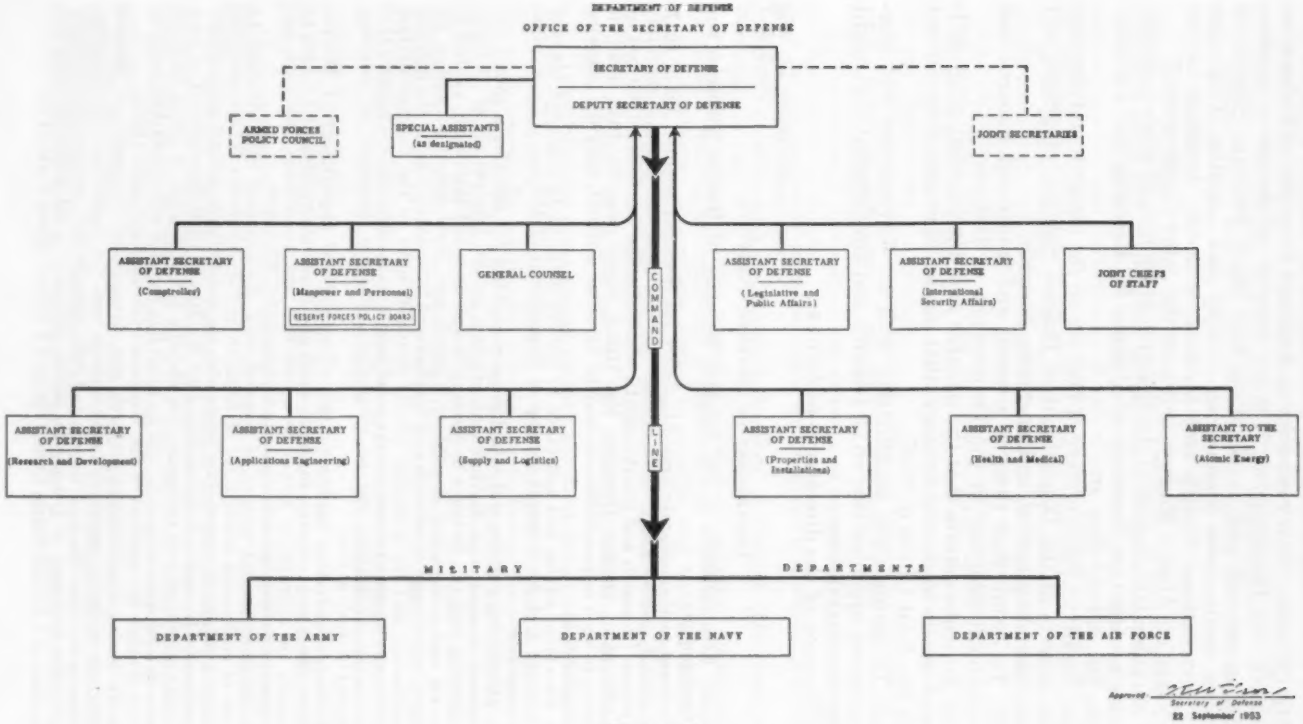
DEPARTMENT OF DEFENSE
OFFICE OF THE SECRETARY OF DEFENSE
SECRETARY OF DEFENSE
DEPUTY SECRETARY OF DEFENSE
ARMED FORCES POLICY COUNCIL
SPECIAL ASSISTANTS (as designated)
JOINT SECRETARIES
ASSISTANT SECRETARY OF DEFENSE (Comptroller)
ASSISTANT SECRETARY OF DEFENSE (Manpower and Personnel)
RESERVE FORCES POLICY BOARD
GENERAL COUNSEL
COMMAND
ASSISTANT SECRETARY OF DEFENSE (Legislative and Public Affairs)
ASSISTANT SECRETARY OF DEFENSE (International Security Affairs)
JOINT CHIEFS OF STAFF
ASSISTANT SECRETARY OF DEFENSE (Research and Development)
ASSISTANT SECRETARY OF DEFENSE (Applications Engineering)
ASSISTANT SECRETARY OF DEFENSE (Supply and Logistics)
LINE
ASSISTANT SECRETARY OF DEFENSE (Properties and Installations)
ASSISTANT SECRETARY OF DEFENSE (Health and Medical)
ASSISTANT TO THE SECRETARY (Atomic Energy)
MILITARY DEPARTMENTS
DEPARTMENT OF THE ARMY
DEPARTMENT OF THE NAVY
DEPARTMENT OF THE AIR FORCE
Approved
Secretary of Defense
22 September 1953

FIGURE 1

Mr. QUARLES. In my capacity as Assistant Secretary of Defense for Research and Development, it is my duty to collaborate on matters affecting research and development with other Assistant Secretaries such as Applications Engineering, Supply and Logistics, Properties and Installations, Health and Medical, with the Assistant to the Secretary on Atomic Energy, and with the Joint Chiefs of Staff.

I am submitting a copy of the directive which lists all of my responsibilities as Assistant Secretary of Defense for Research and Development, but in brief they are:

(*a*) To advise the Secretary of Defense on the research and development aspects of the Department of Defense policies, programs, and plans, including capital and operating budgets;

(*b*) To assure that there is a sound and integrated research and development program in the Department of Defense;

(*c*) To make certain that the research and development program is geared closely to current strategy; that means, of course, close contact with the Joint Chiefs of Staff;

(*d*) To assure close coordination with all Government and nongovernment organizations on all research and development that might affect national defense.

(The copy of the directive is as follows:)

November 12, 1953
No. 5128.7

DEPARTMENT OF DEFENSE DIRECTIVE

Subject: Responsibilities of the Assistant Secretary of Defense (Research and Development).

Pursuant to the authority vested in me by the National Security Act of 1947, as amended, and by Reorganization Plan No. 6 of 1953, the Assistant Secretary of Defense (Research and Development), whose position has been established by Department of Defense Directive No. 5105.1, dated June 30, 1953, shall, in addition to such responsibilities as may be hereafter assigned, have the following responsibilities:

1. Providing advice and assistance to the Secretary of Defense and his staff on research and development aspects of Department of Defense policies, plans and programs.

2. Developing policies and establishing procedures for effecting a sound and integrated research and development program in the Department of Defense; for assuring that the Nation's best scientific and technical talents are applied to planning and prosecution of military research and development programs; for assuring interchange of research and development information among the military departments; and for assigning specific responsibilities to the various military departments for research and development programs in cases where it appears that unnecessary duplication will be eliminated, efficiency promoted or economy achieved by such action.

3. Insuring effective implementation of established Department of Defense policies, plans and programs in the research and development area and taking all necessary or appropriate action to insure that the procedures, methods, and practices of military departments are in compliance therewith.

4. Insuring the interaction of research and development with strategy by means of continuous interchange of research and development information and strategic guidance at appropriate levels with the Joint Chiefs of Staff and military departments; by active collaboration with the JCS in their development of joint strategic objectives and estimates; by advising the JCS when it seems desirable to establish joint requirements; and by providing the JCS with operations analysis service through the medium of the Weapons Systems Evaluation Group.

5. Reviewing the proposed research and development budgets and planned obligations (including proposals for allocations from the research and development emergency fund) of the departments and joint agencies and making recommendations to the Secretary of Defense for action pursuant to his authority under the provisions of 5 United States Code 172b and 5 United States Code 171u.

6. Reviewing proposals for construction or expansion of research and development establishements as to need, adequacy and scope; determining the relative urgency of such proposals; and making recommendations to the Assistant Secretary of Defense (Properties and Installations) with respect thereto.

7. Representing or arranging for the representation of the Department of Defense with other governmental, nongovernmental, and international organizations on research and development matters of mutual interest or responsibility.

8. Collaborating with the Assistant Secretary of Defense (Applications Engineering) in the establishment of policies and procedures to assure coordination between research and development and applications engineering phases.

Where advanced technology or new art is involved, such as new electronic systems, research and development, as referred to herein, begins with basic and exploratory research and extends through successful laboratory and engineering field test of prototypes, together with systems analysis and evaluation incidental to such development. Where the art is well established, or parallels closely civil design, such as heavy mechanical equipment in general, research and development witll be limited to exploratory work through the research or breadboard model phases and cognizance will pass to applications engineering at the stage where design of a military item can be undertaken.

The responsibility for projects in borderline cases will be decided by the Assistant Secretary of Defense (Research and Development) and the Assistant Secretary of Defense (Applications Engineering).

9. Collaborating with the Assistant Secretary of Defense (Comptroler) in:

(*a*) Developing guidelines and planning assumptions for the preparation of research and development budgets.

(*b*) Formulating policies and criteria for release of emergency funds for research and development purposes.

(*c*) Establishing requirements for budget and obligation information on research and development programs.

10. Collaborating with the Assistant Secretary of Defense (Manpower and Personnel) in the:

(*a*) Development of policies regarding research on selection, classification, assignment, training, and utilization of personnel, and

(*b*) Consideration of problems related to scientific and technical manpower needs of the Department of Defense research and development program.

11. Collaborating with the Assistant Secretary of Defense (Supplyand Logistics) in:

(*a*) Developing contractual policies and procedures affecting research and development, and

(*b*) Considering the interaction of research and development and procurement and distribution of materiel.

12. Collaborating with the Assistant to the Secretary of Defense for Atomic Energy in establishing policies, and with the Atomic Energy Commission on procedures, to assure that AEC and DOD phases of research and development programs directed toward military applications of atomic energy are imaginatively conceived and properly coordinated to develop the maximum military potential in this area. The direct consultative arrangements required for such coordination shall have due regard for the statutory functions of the Military Liaison Committee.

13. Collaborating with the Assistant Secretary of Defense (Health and Medical) in development of policies and review of medical research programs of the military departments.

14. Collaborating with the Director, Office of Special Operations, on research and development aspects of psychological warfare and the national intelligence effort.

15. Collaborating with the Assistant Secretary of Defense (International Security Affairs) on scientific and technical aspects of international security affairs.

The Assistant Secretary of Defense (Research and Development) is hereby delegated the authority to obtain such reports and information from the military departments as are necessary to carry out his responsibilities and is authorized to request the military departments to issue the necessary directives to obtain such reports and information.

In the performance of these functions, the Assistant Secretary of Defense (Research and Development) will, to the extent practicable, utilize the advice, assistance and appropriate facilities of the military departments. Such utilization shall not, however, be so construed or so utilized as to circumvent the estab-

lished command channels through the secretaries of the military departments for the formal communication of approved policies, plans, or other directives.

Directives recommended by the Assistant Secretary of Defense (Research and Development) which intend to change established policies or procedures or to establish new policies or procedures will be signed upon approval by the Secretary or Deputy Secretary of Defense and their implementation will be accomplished by the secretaries of the military departments or their designated agents.

Department of Defense Directive 5128.7, dated May 5, 1952, Charter of the Research and Development Board, is canceled and all other directives or memoranda or parts thereof, to the extent they are inconsistent with the provisions of this directive, are modified accordingly or rescinded, as appropriate.

C. E. WILSON, *Secretary of Defense.*

Mr. QUARLES. I have borne in mind three cardinal principles in establishing an organization to assist me in performing my assigned functions. First, that imaginative and constructive leadership should be provided at the Secretary of Defense level to ensure the most effective research and development program. Second, that the military departments should be given maximum responsibility for their research and development programs and the maximum latitude in planning and organizing them under the direction of the Secretary of Defense. Third, that the best possible use should be made of the technical advice and assistance from our national scientific and engineering resources.

As you can see from this chart (fig. 2), my organization comprises five major elements: a Research and Development Council, a weapons systems evaluation group, military coordinating committees, technical advisory panels, and staff units.

(Fig. 2 is as follows:)

FIGURE 2.

Mr. QUARLES. I shall comment briefly on each of these elements.

Research and Development Policy Council: The Policy Council advises me, and through me, the Secretary of Defense on major overall policy matters in the research and development area. Its membership includes my deputies and the Assistant Secretary and senior military officers having cognizance over research and development efforts in each military department. Major problems affecting funds, personnel, organization, methods and procedure in the conduct and coordination of research and development in the Department of Defense are discussed by the Policy Council. Implementation of agreements is the responsibility of each department.

Research and development coordinating committees: The research and development program has been divided into 13 areas of manageable size, and a coordinating committee has been established to cover each of these areas. We have such committees on atomic energy; biological and chemical warfare; electronics; equipment and supplies; general sciences; guided missiles; marine craft and underwater ordnance; medical sciences; ordnance; personnel and training; piloted aircraft; special operations; tanks, land and amphibious vehicles. These coordinating committees consist of representatives of military departments, of my office and of the offices of the other assistant secretaries as appropriate, and are charged with the planning, interdepartmental coordination and administration of the programs in their respective areas. They are responsible for taking action with the understanding that dissents within the committees will be referred to me for adjudication.

According to the Department of Defense directive establishing each committee, satisfactory coordination includes (1) review of plans and programs for adequacy and proper balance; (2) interchange of research and development information among departments; (3) specific agreements as to joint activities to achieve integration; (4) approval of major new projects and important changes in such projects prior to initiation; (5) advice to the Assistant Secretary of Defense (Research and Development) on needs for funding research and development activities and facilities. These committees also consider the impact of military requirements on research and development activities; take appropriate steps to encourage adoption of joint requirements where military needs are similar, and evaluate research and development activities for adequacy and timing in view of strategic guidance, technical limitations and advances, and threats to national security.

I might say, gentlemen, that these committees I have just described are in-shop committees. They consist entirely of representatives of the military departments and the Office, Secretary of Defense; and they are the direct in shop means of running this program in their respective areas.

Now, set off opposite these committees we have our panels of technical consultants who are entirely people drawn from outside of the Department of Defense, to come in and give us advice and guidance in respect to the program.

Mr. RIEHLMAN. And some of those are from private industry, Mr. Secretary?

Mr. QUARLES. Private industry; from universities; consultants from specialized fields of technology; wherever we find the best consultant advice we can get.

Technical advisory panels: The technical advisory panels are composed of consultants appointed from among civilian scientists and engineers in the following areas of technology: Aeronautics, atomic energy, biological and chemical warfare, electronics, fuels and lubricants, general sciences, materials, medical sciences, ordnance, personnel and training research, and research in special operations.

I might explain that the words "special operations" refer to what we at one time called "psychological and unconventional warfare." It has to do with all those special procedures that deal with psychology and propaganda; and, in fact, any unconventional method of warfare as distinguished from conventional ways of destroying your enemy.

Mr. BALWAN. Are those assigned to your office?

Mr. QUARLES. Excuse me?

Mr. BALWAN. Is responsibility assigned to your office?

Mr. QUARLES. Responsibility for coordinating research and development in special operations is assigned to my office, but responsibility for the operations as such is set up under a Special Assistant to the Secretary of Defense, General Erskine, who is not in my office. This is the distinction between the operations themselves and the research and development supporting these operations.

Of course, I have to work closely with General Erskine in formulating this program.

I will say further: You will note the field of these advisory panels have some similarity to those of the coordinating committees, but they are not exactly the same as the fields of the coordinating committees. The advisory panels subdivide the field according to the scientific disciplines, whereas the coordinating committees subdivide the field according to the program that we have to administer. There are some differences and some similarities.

From these panels, groups will be drawn out, for the study of designated problems on programs and for technical advice and assistance to the coordinating committees, the military departments, or the Department of Defense in the administration of the program. Such advisory panels are asked to report their findings and particularly any dissents they may have from the technical plans and programs of the departments so that I may take appropriate action.

Weapons systems evaluation group: The weapons systems evaluation group reports administratively to the Secretary of Defense through my office. This group is concerned with analyses and evaluations of new weapons systems and it provides the Joint Chiefs of Staff with operations analysis service so that maximum use can be made in strategic planning for modern warfare of the choice of weapons systems in the light of available resources, costs and advancing technology.

Staff units: Lastly, the staff units consist of my deputies, administrative staff, a Planning Division and a Resources Division. These staff units assist me, the coordinating committees and the technical advisory panels in the discharge of their responsibilities.

Contemplated changes in organization and administration of this program—this is responsive, sir, to one of your questions.

Mr. RIEHLMAN. That is right.

Mr. QUARLES. I have mentioned that the reorganization plan became effective on June 30, 1953, an that I became Assistant Secretary of Defense on September 1. Hence, we have been operating under our new setup for a relatively short period. Nevertheless, I am very

optimistic about the new organization and I do not anticipate any major changes in the near future.

Direct costs of the Department of Defense research and development program for fiscal years 1953, 1954, 1955: The direct costs of the Department of Defense research and development program for the fiscal years in question are as follows:

Fiscal year 1953, $1,331,238,000.

Fiscal year 1954, $1,238,500,000.

Fiscal year 1955, $1,210,710,000.

The fiscal year 1953 costs are based on reported actual obligations; those of the following years are based on new obligational authority as appropriated for fiscal year 1954 or as requested and now pending in legislaton for fiscal 1955.

Estimate of indirect costs allocable to these programs to the extent that this is feasible: For fiscal 1954, the departments reported an indirect cost from maintenance and operations allocable to research and development of about $150 million. This estimate does not include costs of military personnel or capital facilities. If an allowance is made for military personnel, the additional costs would approximate $125 million. The new obligational authority appropriated by Congress for fiscal 1954 for research and development capital facilities amounted to $18,562,000. Hence, an estimate of the total indirect cost allocable to research and development for fiscal 1954 would be approximately $294 million. Of course, it should be realized that it is sometimes very difficult to draw any clear line between research and development and other functions of the military departments such, for example, as evaluation testing or training. Because of this "gray area" about which there can be legitimate defferences of opinion, there can be various estimates of the value of indirect costs arising from military support functions.

Mr. RIEHLMAN. Mr. Secretary, before you proceed to answer the questions which were sent to you, I wonder if you would mind if the members of the committee would ask some questions at this time, if they have them.

Mr. QUARLES. Certainly not, sir.

Mr. RIEHLMAN. I think it would be better, rather than to go into the other questions that were asked.

Mr. QUARLES. Right.

Mr. RIEHLMAN. Mr. McCormack, have you some questions you would like to ask the Secretary?

Mr. MCCORMACK. Well, the Secretary, of course, has just started to read his statement. I do not know whether I should confine it to that, or ask questions generally.

Mr. RIEHLMAN. I think if you have any questions in connection with the statement he has made it would be better than going into the general questioning, because some of those questions may be cleared up as he answers these questions. Even at the close we certainly will open it up for any general questions you would like to ask.

If you have anything pertaining to his presentation up to this time, please ask your questions.

Mr. MCCORMACK. What is this "gray area" you have referred to, where you say, "There can be legitimate differences of opinion"? For example, what would that cover?

Mr. QUARLES. Well, for example, I have not included in supporting research and development costs of the departments, which they may spend in operational evaluation of a new development. This is just part of the game of preparing them to use new weapons. We have not construed that as being a research and development cost, although one could so interpret it.

There are various things of that kind in working new developments into service that one could construe as research and development costs, but that we have not so construed.

I only mention that there is a "gray area" where different people have used different definitions so that one could arrive at a different number than $294 million, if you use a different definition there. That is all I meant there, Mr. McCormack.

Mr. RIEHLMAN. Would you yield at this point just a moment?

Would it not be proper to list an experimental program which is being carried on by the Air Force, such as Patrick Field, in this gray area, because they have a tremendous program on down there and a lot of it is in the guided missiles end, and of course it is tied in with research and development.

Mr. QUARLES. But the Patrick Air Force Base work is, generally speaking, included within what I have either called direct expense or what I have labeled as indirect expense. For example, the military personnel at Patrick Field would not be included in the direct expense but they would be included in this $125 million I mentioned as being indirect expense.

Mr. RIEHLMAN. I see. That would be included in there?

Mr. QUARLES. Yes, sir.

Mr. RIEHLMAN. All of the operational costs and so forth of the military?

Mr. QUARLES. And in fact in that case, as you know, Patrick Field is now going into an operating contract with a private company or companies, and the contract expense will now appear as a direct research and development expense.

So the point I make is that the work at Patrick Air Force Base would now, I think, completely be included in one or another of the 3 categories I have named; either direct R. and D. expense, or indirect military personnel expense, or, or course, capital improvements, which would come into the capital budget; all of which I included here.

Mr. RIEHLMAN. Then we are to conclude that for fiscal year 1954 we have here $1,238 million. We would add to that about $294 million and we would have a pretty accurate cost of the whole program.

Mr. QUARLES. Using my definition of indirect cost; yes, you would, sir. My definition of supporting costs.

Mr. RIEHLMAN. Yes.

Mr. QUARLES. Which I think is a fair definition.

Mr. RIEHLMAN. Mr. McCormack.

Mr. MCCORMACK. I notice you have an unusual background, Mr. Secretary. I am aware, through sources that I have, of the contributions you have already made.

Mr. QUARLES. Thank you, sir.

Mr. MCCORMACK. What is your opinion as to the importance of research and development work in connection with our military organizations?

Mr. QUARLES. Well, as you can imagine, Congressman, I would tend to put that near the top of the list; perhaps just as a matter of prejudice, one might say; but actually I think it is fair to say that I put it at the top of the list before I came into the job.

It seems to me we must regard the research and development program as our system in this democracy for mustering the best that science and technology can do for this country and keeping it ahead of our competitors in an international sense, having in mind their great manpower superiority. This seems to me to be the one great bulwark we have to defend this Nation in the future against what would otherwise surely be a superior military force.

Mr. MCCORMACK. One of the great problems is reconciling the thought and the actions of the military and the scientist; is that right?

Mr. QUARLES. It is. In the broadest sense, I think the problem here is to bring the military and the scientists and the engineers together, into a common team.

Mr. MCCORMACK. Of course, in the case of the military you have a man who is subject to discipline all of his life.

Mr. QUARLES. That is right. We must recognize that this means that they approach the problem from a different angle. But in my experience there has never been any difficulty—excepting only exceptions—in getting the military man and the scientist to feel a brotherhood of team play in getting together on this problem. I do not find this discipline you speak of as any bar to complete mutual understanding of the two sides here.

Mr. MCCORMACK. On the other hand, of course, the scientist is pretty much a member of a group which is just the opposite of the military theory.

Mr. QUARLES. I think that is a fair statement. His whole background and training, you might say, are to liberalize his thinking rather than to regiment his thinking.

Mr. MCCORMACK. And there are different groups or activities within the field of science, such as basic science.

What is the importance of basic science in connection with our military organization?

Mr. QUARLES. Well, viewed over a long term and very broadly basic science, of course, is the very foundation on which our whole technology is based. That means that if we are to have our program planned in its broadest sense we must be sure to enrich the basic science foundation of it as well as to work hard on the application of science to our narrow term problem.

Mr. MCCORMACK. I take it a good bit of basic science is more or less of a gamble.

Mr. QUARLES. Basic science is a gamble, surely, in the sense that by definition it is carried out in a stage where one cannot say that it will be useful in such-and-such a specific sense.

Mr. MCCORMACK. In other words, they are exploring, more or less, into the unknown?

Mr. QUARLES. Right. Still, if one reads history, I think the gamble is not really a very great gamble, because we have always found that broadening our basic science horizons has broadened our technology and our ability to do new things.

Mr. MCCORMACK. I used the word "gamble" purely in a descriptive way. I think your observation is correct, and one with which I agree.

But, nevertheless, the individual scientist, or a group of them, has theories and ideas and views on a lot of projects that are not successful?

Mr. QUARLES. You are very right.

Mr. MCCORMACK. Yet one might be successful, which might be the turning point, for example, in determining the greater offensive strength.

Mr. QUARLES. And frequently things that may lie fallow for years appearing to be not useful for military purposes may later on fit into something else which makes them very important things.

One example which I am sure you are all well aware of is the whole area of nuclear physics. Many of these exciting new things to the nuclear physicist seemed to be completely removed from the practical area until about 1938 or 1939 when the physicists found they could derive a tremendous amount of energy by splitting certain atoms. This thing then led into now what has become a tremendously important thing in the military sense. That is the way the thing unfolds and works out.

Mr. MCCORMACK. I have no further questions now, Mr. Chairman. I was going to ask later about your viewpoint as to the existing law and regulations promulgated thereunder, and whether you think they enable that flexibility to accomplish the maximum results. That can come later.

Mr. QUARLES. I think you will find my answers to the other questions somewhat responsive to that.

Mr. RIEHLMAN. I think so. Mr. Ikard?

Mr. IKARD. I would like to ask one or two questions here. If you have answered them further on in your statement I hope you will say so, to save us all time.

I notice on page 3 you mentioned the atomic cannon and several of the guided missiles. I would like to know in your organization setup and your experimentation and development of research where along the line in your organization you have the group that says, "This is it; this is the model we are going to use."

In other words, where does your research stop and your production begin; and who makes that determination?

Mr. QUARLES. Well, let us take the atomic cannon, just to illustrate the point.

Mr. IKARD. Yes.

Mr. QUARLES. Because it would be typical. The atomic cannon, of course, is a project of the Army, and within the Army it is assigned for responsibility for development and production to the Army Ordnance Corps.

On the nuclear projectile side of the thing it is a project of the Atomic Energy Commission in their laboratories out in New Mexico.

In this case the Ordnance Corps and the atomic energy laboratories recognized the possibility of producing an atomic projectile and adapting it to a gun that the Ordnance Corps had already advanced fairly far toward development. A collaborative setup was arranged between the Ordnance Corps and the Atomic energy laboratories for the development of the projectile, and the Ordnance Corps itself completed the development of the gun, the carriage and all, for this purpose.

The organization then was different. Were that done today the Ordnance Corps would propose to the Army that it establish a project for this whole development and fund it, let us say, with a certain number of millions of dollars per year over a period of development. That proposal would be forwarded by the Army to my office, under the Secretary of Defense, where it would be studied. We would call in these consultants, maybe, to advise us about highly technical problems involved in it, and then our coordinating committee on atomic energy in this case, would weigh all these aspects of the thing.

Let us say they agreed it was a project that should have support. The Secretary of Defense would then, we will assume, approve their plan for the project and authorize funds to them for the project, and the Secretary of Defense, through the Military Liaison Committee, would ask the cooperation of the Atomic Energy Committee in performing their part of the program.

You then proceed—two sides of the house working together—to complete the development. Models, of course, are constructed and are proof tested and checked against the requirements for the weapon.

If the development is found to be successful in meeting the requirements and in the judgment of the Joint Chiefs of Staff is considered to be a weapon needed by our operating forces, then its standardization is authorized and it is procured in quantity for training and so on.

Mr. IKARD. Where you have a situation with a sharp conflict of opinion what is the case? Let us take the guided-missiles program, for instance, where you are building the ground-to-air or the ground-to-ground missiles. Let us say that you have, just for the sake of an example here, the two arms of the service, the Air Force and the Army, working on a project, and there is a sharp division of opinion between those two, one saying, "We have it here," and the other saying "We have it here."

While competition, we will all agree, is good; beyond a certain point it can be very expensive. Where there is that sharp division of opinion who in your organization pulls them together and says to the Army, "We are not going to take yours; we are going to take the one from the Air Force," or vice versa, whatever the decision might be?

Mr. QUARLES. The Coordinating Committee on Guided Missiles is the organization responsible for doing that. The three Departments come together there. My deputy is the chairman of that committee. They sit down and mull over their programs.

Probably in such a case as you mention, that would prompt them to pull in advice from consultants in this field, to be sure they understand the problems in the broadest sense.

Mr. IKARD. Pardon me, sir. The point I am trying to get at is this: Who has the responsibility and authority when you get to the point where you cannot reconcile differences around the table? Who then has the authority to say, "Gentlemen, we have talked about this long enough. This is our project."

Mr. QUARLES. Right. If the coordinating committee can reach a coordinated view in which everybody will agree, then you do not have the problem.

Mr. IKARD. That is right.

Mr. QUARLES. If they cannot, the problem then lands on my desk.

Mr. IKARD. That is what I wanted to know.

Mr. QUARLES. Then I have to recommend to the Secretary of Defense either that he continue to fund both of them—that is, authorize funds for both of them—or that he drop one or the other, or maybe drop both. Of course, then, in the final analysis you might say it is my responsibility under the Secretary of Defense to make this determination; and he finally signs the papers which will accomplish what you are bringing out here.

Mr. IKARD. Without reference to any specific program, is that a serious problem in your organization? Do you have a situation such as that occur with any degree of frequency?

Mr. QUARLES. Yes, it is a serious problem. In fact, you might say the key problem at my level in this program is to decide how much competition and initiative to allow, and at what point to saw it off and concentrate on a single program.

Mr. IKARD. It seems to me that would be the real essence of the program.

Mr. QUARLES. It is. That is right.

Mr. IKARD. In your mind from your experience so far, is there any feeling that the organization should be changed to correct that specific thing, or do you think it will work out all right as it is?

Mr. QUARLES. I think that the new organization is adequate to care for the problem that you speak of, assuming we should have, as I believe we should, some amount of competition between the departments in their urge to supply themselves with the best weapons.

Mr. IKARD. I agree with that viewpoint, but I also think it is very important that there be somebody some place that can say, "Now, we have gone through this long enough and we have to standardize on something."

Mr. QUARLES. That is the great merit of the new organization over the old. You see, in the new organization the Secretary of Defense has complete authority over these matters. Of course, he cannot give personal attention to all of them, so in this particular area he has designated me to act for him, or at least to act so that he may only have to sign papers in general rather than himself be the judge of all these matters.

Mr. IKARD. I believe that is all, Mr. Chairman.

Mr. LIPSCOMB. Mr. Quarles, how often do these advisory and technical panels meet?

Mr. QUARLES. The advisory panels meet as a group only rarely, but as problems come up a small number—maybe two or three consultants who are particularly appropriate for that problem—will be assigned to it and they will meet, let us say, for a whole week going around studying the thing, and they might meet again a week later and give concentrated attention to that problem until they have a recommendation on it. Then that would settle that problem and they would wait to be assigned to another problem.

The advisory panels, as such, do not have frequent meetings because they do not act as panels. They merely are a panel from which you draw small groups to study problems.

Mr. LIPSCOMBE. Have you called upon the technical advisory panel often since September 1953?

Mr. QUARLES. Oh, yes. Every one of these panels has a whole agenda of problems that they are now studying. In fact, I have a number of specific pieces of advice from them in a number of activities.

Mr. LIPSCOMB. Have they ever indicated to you they were dissatisfied with the organization of the advisory panels?

Mr. QUARLES. They have not. On the contrary, without exception, they have indicated an enthusiasm for the new organization.

Mr. LIPSCOMB. Then, with regard to this amount that you have asked for appropriation, do you anticipate, or do you see this research and development program expanding over the years?

Mr. QUARLES. I think we are now at about as high a level as would be wise for us to go, so I do not see an expanding in its level as compared with the present level. We are using something like half of the research and development potential of the country in defense research and development. It seems wise to me not to go much further than that on a long-pull basis.

Mr. LIPSCOMB. I notice from your appropriations that since 1953 you have gradually reduced the amount that you have required.

Mr. QUARLES. That is right. That is because of what I call the Korean transient in the whole picture. Before Korea we were going at about a half billion rate. With the Korean transient, we tried to step that up to a billion and a quarter rate. That is multiplying it by 2½. Now, this is bad thing to do in anybody's business, but what we are now trying to do is to stabilize after that transient effect came in.

Mr. LIPSCOMB. That is all that I have, Mr. Chairman.

Mr. RIEHLMAN. Mr. Lantaff.

Mr. LANTAFF. I have no questions.

Mr. RIEHLMAN. Mr. Quarles, there is a President's Scientific Advisory Board in existence headed by Mr. Fleming?

Mr. QUARLES. Mr. Fleming is the Director of the Office of Defense Mobilization, and he has under him a Science Advisory Committee, so-called, headed by Dr. Dubridge.

Mr. RIEHLMAN. Is there any coordination between your shop and their field activity? Do you get advice from them, or have they ever offered any helpful advice to your field activity?

Mr. QUARLES. I always meet with them and hear their proposed actions and discuss their proposed actions with them and I feel that there is a close relationship, but I am not a member of that advisory committee, although my predecessor, the Chairman of the Research and Development Board, was such a member. In the new organization it seems proper to maintain a certain separation or independence between the Department of Defense and the Office of Defense Mobilization, but there is, however, very close working relationship between us.

Mr. RIEHLMAN. Do you meet frequently to discuss these problems?

Mr. QUARLES. That committee meets, I would estimate, about once every 2 months. I meet with them when they do meet.

Mr. LANTAFF. I have a question. Is there any competition between the Office of Defense Mobilization and the Defense Establishment for the services of individual scientists?

Mr. QUARLES. Well, I would say not today because the Office of Defense Mobilization has a very nominal number of scientists tied up in its work today. This committee may involve something on the order of 15 or 20, and they are not at all full time. Many of those

same scientists work on our program, so as of today I think you can say there is not much competition.

Mr. LANTAFF. What is their function?

Mr. QUARLES. Do you mean the Science Committee or the Office of Defense Mobilization?

Mr. LANTAFF. The Office of Defense Mobilization.

Mr. QUARLES. This is a big subject, but during the war the Office of Defense Mobilization exercised for the President the function of judging as between civilian claimants for materials and the resources of the country and military claimants.

Now, in the reorganization after World War II, the Office of Defense Mobilization was retained in this same broad function—relating to civilian claimants and things of that kind to the operation of the Military Establishment.

For example, in the stockpiling of strategic materials, the Military Department gives the Office of Defense Mobilization its estimate of requirements for different strategic materials and the responsibility for stockpiling is the Office of Defense Mobilization's responsibility rather than ours. That just illustrates the point.

Mr. MCCORMACK. Mr. Secretary, you have given testimony about the military initiating projects. What about the scientists initiating projects?

Mr. QUARLES. The scientists, of course in their own laboratories, do initiate their own projects, and in basic science in many cases our operation is merely to support the projects which they, themselves, are initiating and which we believe to be valuable in our program.

Mr. MCCORMACK. And that is where a man with your experience comes in?

Mr. QUARLES. Right.

Mr. MCCORMACK. It is very important to have the qualified administrator.

Mr. QUARLES. To judge what values these things may have.

Mr. MCCORMACK. At the present time does the military decide whether or not a project shall be continued?

Mr. QUARLES. The military departments initiate research and development projects and continue them either to completion or decide to discontinue them. But all such actions are subject to coordination in the Coordinating Committee in my office, which I described. Any major change in a major project would come in that Coordinating Committee for review.

Mr. RIEHLMAN. In the initiating and carrying out of the program you would have no direction or jurisdiction over that; is that correct?

Mr. QUARLES. I would have jurisdiction over it because the funding of all programs is the responsibility of the Secretary of Defense, and research and development is my responsibility.

Mr. RIEHLMAN. So if you felt a program that anyone of the services had instituted was not proper, you could see that the funds were cut off; in other words, the program would certainly not continue, is that correct?

Mr. QUARLES. That is correct.

Mr. MCCORMACK. Do you know of occasions where a project has been satisfactorily completed to be rejected by the military?

Mr. QUARLES. Where it has been satisfactorily completed and then rejected by the military?

Mr. McCormack. Yes.

Mr. Quarles. No; I do not.

Mr. McCormack. That is, in the opinion of the scientists where there is a conflict.

Mr. Quarles. In our present setup the scientists would not complete the project unless the military were back of it and supporting it; so I do not know of a case where there has been a project completed and the military has rejected it.

Of course, there have been researches completed which are not directly related to projects and which have not been immediately applied by the military, and there have been developments completed, such as competing developments, where only one would be selected for standardization.

I hope that I am being responsive to your inquiry, if I understand you.

Mr. McCormack. I consider that you are responsive, even if I am just seeking information.

You said if the military is in back of it. Does that mean that there is a dominance of military thought?

Mr. Quarles. In the research phase of the job there is not a dominance of military thought. The thought there is merely to give scientists in areas of military interest latitude to work in the directions they think it wise to work. That is in research. But once we start a development of a particular piece of gear, then the military people do dominate the definition of what kind of gear should be developed.

Mr. McCormack. Do you have the responsibility you think you should have for one in your position?

Mr. Quarles. The answer to that is "Yes." May I qualify it? The Secretary of Defense has complete responsibility in this area, and he has delegated to me certain functions in this area and in that sense I think my office has the responsibility that it needs.

Mr. McCormack. What about the military? Do they have men with the background to deal with science?

Mr. Quarles. Generally speaking, yes. There has been an enormous change in our uniformed personnel since 1940. In 1940 science was a comparative stranger to our uniformed personnel and since that time they have been thrown into so many of these situations, and we have had new and younger people with special training coming along so that today, generally speaking we have a very high degree of competence in our uniformed personnel; not in performing research but in understanding the potentiality of research.

Mr. McCormack. Have we been losing many of our scientists in recent years in the military?

Mr. Quarles. We have had some losses. I believe, sir, I will cover that point later if you would like.

Mr. Riehlman. Do you have any other questions at this point, Mr. McCormack?

Mr. McCormack. No.

Mr. Riehlman. You may proceed with the questions presented to you.

Mr. Quarles. I will now give you my views on the questions and problems which were set forth in the enclosures to the Chairman's letter.

1. Are there any characteristics inherent in military organization which are incompatible with the administration of an effective program of scientific research and development?

If in this question the words "Military organization" are used to describe the kind of organization that we now have for the military research and development program then I must say that I do not believe that there are any characteristics inherent in it which are incompatible with the administration of an effective program of research and development. This is not to say that these organizations are without administrative problems or are always free from influences detrimental to efficient operation but these influences have their origin in human failing rather than in characteristics inherent in the setup.

Mr. RIEHLMAN. I think maybe at the end of each of these answers, if there are any questions by the members it would be best to raise them at this time rather than going back and covering it.

Does anyone have any questions in respect to that answer?

Mr. MCCORMACK. What do you mean when you say that you are always free from influences detrimental? Will you give us an illustration?

Mr. QUARLES. We have at times particular military and particular science people who are thrown together and who develop incompatibilities of various kinds of a human sort. And these are personal problems which are detrimental to the best operations when they do occur.

Mr. MCCORMACK. That is what you particularly had in mind when you used that language?

Mr. QUARLES. That is the particular thing.

Mr. MCCORMACK. Based upon your experience, what have you found the difficulty to be mainly due to?

Mr. QUARLES. Well, it is mainly, of course, due to the completely different background of the individuals involved. Although I must say from my own experience, where people were supposed to have the same background we do, from time to time, encounter these conflicts in personalities, so I think one must not overemphasize the military versus the scientists' aspect of the thing. But that is certainly a factor in it.

Mr. LIPSCOMB. For what reason are these scientists and military people thrown together? Is the military supervising the scientists?

Mr. QUARLES. Our philosophy in these military laboratories and technical organizations of various kinds—and some of them, for example, are test organizations—is that we must, to be successful, bring together in the laboratory the military point of view as to what would be useful from a military standpoint, and the scientists' point of view as to what science and technology can, in a practical sense, accomplish. In general, what we do is to have at each such center a military commander who is the commander of the center in a military sense, and the scientist organization, the technical organization, which is a separate thing within the establishment headed by scientists and in general operated all the way down the line by scientists and engineers, although sometimes we have military people with scientific qualifications working right down in the laboratory in this civilian organization just as though they had no uniform on. That, however, is a rather exceptional thing.

Mr. LIPSCOMB. Does the military commander of that particular post have any technical knowledge at all when he gets on the post?

Mr. QUARLES. As I mentioned earlier, the people that are selected, the military, for these assignments are the ones that should be assigned according to the best judgment of the military department assigning them, and today we have a lot of military people who have a very adequate understanding of technology but not in the sense of being scientists.

Mr. LIPSCOMB. With regard to this program of military rotation, how often does that happen at one of these posts where they are doing scientific research and development?

Mr. QUARLES. The rules of the military department vary in this respect, but the ordinary thing would be from 1 to 3 years at such an assignment. Unless there are special circumstances. It would be the longer rather than the shorter period.

Mr. LIPSCOMB. Does it ever occur where a scientific development is going on and there is the rotation and a new commander comes in that they have difficulties at that point because of a conflict in personalities and all of that?

Mr. QUARLES. It does occur, and perhaps the initial readjustment is the hardest part of the cycle, but I would not want to give you the impression that it is normal to have an upset at such a time. It is not. Ordinarily that readjustment is made smoothly.

Mr. LIPSCOMB. Where does this misunderstanding come, in the technical field, or in the personality field, when they have to conform to military restrictions of some sort?

Mr. QUARLES. It may come from a feeling on the part of the scientist that a military man is trying to tell them too definitely what they should do; trying to regiment them too much in an area that he is not competent to dictate in. It may come from a feeling that he is instituting policies that look too much like a military base rather than a laboratory. There are all kinds of possibilities of that sort. I recall an incident where a new military commander when he was visited by some top brass suggested that his key scientists join him at the airplane to greet these people as they got off the airplane. Well, they thought they were being regimented. They thought they were being made to act like colonels or generals or something, and they resented it. It shows you people can have strange ideas about these things, and you have to work them out on a human basis.

Mr. MCCORMACK. Are there some military men who attempt to apply the discipline and obedience of the military to civilians?

Mr. QUARLES. I think not in a literal sense because in each one of these establishments there are statements of policy which are recognized by the military and the civilian heads, and these statements of policy make it clear in all cases there is no thought of applying military discipline or routines to the civilian part of the personnel. I think in a literal sense we do not have the kind of thing that you speak of.

Mr. MCCORMACK. Are you talking about now, or say 2 or 3 years ago?

Mr. QUARLES. I am talking about now.

Mr. MCCORMACK. I assumed so.

Mr. QUARLES. I think it is true that some of this has been worked out in the period of 2 or 3 years. The last several years have certainly seen improvement.

Mr. LANTAFF. As I get this picture, the role of the military versus these scientists is that the military have to judge that even though the scientific research and development might be successful, that notwithstanding that fact, they might develop weapons that would not be practical for the particular application of that arm of the sevrice; is that correct?

Mr. QUARLES. It is a possibility, but there is an attempt to have such coordination that you would not carry a development through unless it were well calculated to meet the requirements of the service.

Mr. LANTAFF. Well, let us just apply it to research. That would be resolved first within your coordinating committee?

Mr. QUARLES. Yes.

Mr. LANTAFF. At the defense level; is that correct?

Mr. QUARLES. Yes, it would, but I would like to be sure we are not misunderstanding each other.

Mr. LANTAFF. Let us take a practical example. Suppose that the scientists determine that they could develop an atomic rifle and the military determined that such an atomic rifle would be 83 pounds and it would not be worth developing, but from a scientific viewpoint it would be well worth trying, seeing into how small a weapon they could introduce atomic energy, so you might have a basic conflict on something like that as to where to go ahead. In that case, who would resolve the conflict between the military and the scientists?

Mr. QUARLES. If it were a matter of developing an atomic rifle that was impractical——

Mr. LANTAFF. I mean as to research in that field.

Mr. QUARLES. If it were a matter of performing researches that might make it possible to develop such a rifle, we would probably authorize it because of its general interest. We might say that we would not want that kind of a rifle, but you might still be able to use that principle in some other way. So my point is then in research we try to leave latitudes and not regiment. But when it gets to developing a rifle or a weapon, then the military state their requirements and the military characteristics that should apply, and it is then up to the technical organization to meet those requirements. In that phase they are regimented, if you like, to that extent.

Mr. LANTAFF. Taking it on down to the base level where you have your research centers, might it be possible that some of the conflict between the scientists and the military would stem from the authorization of a research project which some military man thought was wholly impractical, and would he be authorized to direct those scientists to work on some other project and to abandon the particular one, or to put effort on something else he has more interest in?

Mr. QUARLES. He would not be authorized to do that in those institutions where such research is carried on. Comparatively few of our 100 or so technical laboratories and the like in the Military Establishment perform research of the kind you are speaking of.

Mr. LANTAFF. That would be under contract?

Mr. QUARLES. They work on exploratory matters directed toward particular weapons.

Mr. LANTAFF. Suppose you are in the development stage and you have a new officer that comes in that is wholly out of sympathy with the practical application to a weapon that has been authorized for

development, what would he be able to do under those circumstances to hinder the scientists in developing that weapon?

Mr. QUARLES. The development program for his laboratory, or development center, whatever it may be, is laid down for him by the technical bureau having cognizance of it. For example, if it were at Inyokern, the Bureau of Ordnance of the Navy would have cognizance of the technical program at Inyokern, and the commanding officer at Inyokern would merely reflect the program given to him by the Bureau of Ordnance in Washington for his establishment. He would not, himself, order things to start and stop.

Mr. LANTAFF. Suppose that he determined that he has more work assigned to him than he can possibly carry out with the scientific bodies available to him, can he then evaluate the program himself and order the scientists to carry on with projects A, B, and C, and discontinue E, F, and G?

Mr. QUARLES. In general not. In general, it is up to him to establish the relative priorities of those programs with his bureau and simply reflect those relative priorities to his people, his scientists.

Mr. LANTAFF. Does the Bureau decide those relative priorities, or would that be referred back to a higher echelon for resolving?

Mr. QUARLES. If it were within the program that had been approved on the Department of Defense level, the Bureau could decide it. If it involved initiating new programs, for example, the Bureau could not decide it.

If it involved the matter of departing from the priorities established at the Department of Defense levels, the Bureau could not depart from those priorities, but within those limits the Bureau could decide it.

Mr. LANTAFF. Do you know whether or not there has been any such conflict that has come to the attention of this committee?

Mr. QUARLES. There have been cases where the center or some scientists in the center did not agree with the relative priorities assigned by the bureaus. Each man thinks his project has the highest priority and that kind of thing, so there is a certain amount of give and take there, but I think it is rare that that has developed into an open hostility about the matter. The people conform to the judgment that is given to them by, let us say, people in higher echelons who have a better basis for judgment.

Mr. LANTAFF. That is all.

Mr. RIEHLMAN. Mr. Secretary, before we go on to the next question, you say in your statement that you have 67 percent of the dollars spent in research and development for those projects farmed out to universities and other institutions.

Mr. QUARLES. And industry, primarily.

Mr. RIEHLMAN. Who makes the decision upon the type of program that shall be carried out in these institutions or in private industry, and has there been a study made of any duplication and overlapping in these different projects? How is that handled?

Mr. QUARLES. As to the overlapping, this again is a coordinating committee function. They look at the project, let us say independently of where it is to be performed, to see that it has a proper place and that there is not an overlapping with something else that is being done, so it is coordinated in that sense, first, by the depart-

ments, but then finally by our coordinating committees in the Department of Defense.

Now, as to whether a project should be carried out within the shop laboratories of the Department, or contracted to industry, that is controlled largely in this way: There are certain kinds of things that you have to do in-shop. For example, most of our biological and chemical warfare program, and particularly the biological program, is carried out within the organization laboratories of the Department of Defense, and in this case the Army. Similarly, the kind of work that is done at Patrick Air Force Base that you mentioned requires a military establishment because no university or private industry would have facilities of that kind.

Similarly, certain kinds of works on explosives and explosive warheads and tests of armor and things of that kind would be done within the Military Establishment.

Now, the 67–33 percent split depends on the facilities and the ability of these departments to do certain kinds of work themselves and their inability to do the development of weapons that require industry to make them. That kind of thing we get out into industry from the start.

Mr. RIEHLMAN. Those contracts, as they are let, go through your shop; is that correct?

Mr. QUARLES. No; they do not.

Mr. RIEHLMAN. Where do they originate?

Mr. QUARLES. They originate in the departments, and the projects and the funding for them go through our shop, but the actual contracting for them is the function of the contracting officers of the individual departments. The Ordnance Corps of the Army would have a contracting officer who would actually make such contracts.

Mr. RIEHLMAN. But your Department is charged with the whole responsibility of research and development.

Mr. QUARLES. And for seeing that the program which the Ordnance Corps institutes is an approved program and at an approved funding level. But the actual supervision of that program and the contracting for it with industry is in that case a function of the Ordnance Department.

Mr. RIEHLMAN. The Ordnance Corps itself?

Mr. QUARLES. Right.

Mr. RIEHLMAN. And you have no jurisdiction over that 67 percent, then?

Mr. QUARLES. Oh, yes; we have because in shaping up the program in the first place, the character of the program determines how much of it you have to contract out to industry and how much of it would be done in shop.

May I illustrate that in this way: If we approve a new guided-missile development, that guided-missile development is for contracting to an industry some place, you see. That is not the kind of work that would be performed within one of these establishments, in the shop establishments. So by fixing the whole character of the program in the first place we really fix how much of it would be contracted outside, and moreover, by controlling the establishment of new laboratories of this kind within the Department of Defense, we have an additional control on any tendency to pull this work into the military departments.

Mr. RIEHLMAN. Do you feel under this Reorganization Plan No. 6 that you have enough jurisdiction and authority to do that?

Mr. QUARLES. I do feel so, that we have jurisdiction and authority enough to exercise the proper restraints over these things.

Mr. IKARD. Do I understand then, to reduce this to a practical situation, that your shop actually approves these programs in the broad scope, and then the operating branch of the services, through their contracting officer, will carry out the actual execution through the contract with some company in industry?

Mr. QUARLES. That is exactly right; yes.

Mr. IKARD. Now, we have talked here some about these research centers where there might be a scientist associated closely with the military. Just what is, organizationwise, the setup of those centers? I mean by that, is the top scientist subordinate to the military commander? Organizationwise, what is the situation, Mr. Quarles?

Mr. QUARLES. In a strict organization sense, the top scientist usually is subordinate to a military commander at that post. That subordination, however, is administrative rather than technical, if you see the distinction that I make.

Mr. IKARD. Yes.

From an administrative standpoint—to get into something that Mr. Lipscomb asked something about—do you have any cases, or have you had many, where the military commander has tended to subordinate, from an administrative standpoint, the scientists on the base to where it became intolerable, at least from the scientist's standpoint?

Mr. QUARLES. There have been instances of that kind, and it would be wrong to give you any other impression, but let me just point out that this military man goes in there to do something for his department, and the only effective thing he can do for his department is to make that a place where people want to work and where people will work in good spirit and will get things done. So it immediately becomes a measure of his own personal effectiveness whether he produces that kind of cooperation and atmosphere, or whether he fails to. This is the reason that it is a rare thing that such a thing happens rather than the ordinary thing.

Mr. IKARD. Now, the military system has in itself certain qualities in order to perform the mission that it does.

Mr. QUARLES. Surely.

Mr. IKARD. Strict discipline and other things which we all recognize as essential. Has that background in the military, where they observe a strict chain of command, and discipline, created any difficulties of any major proportion? I am not interested in some isolated example. Is it a problem?

Mr. QUARLES. It is a problem that I think is under control, and it is under control by virtue of the fact that it is well recognized and stated in clear policy statements that we should not undertake to have that kind of military discipline in carrying out this kind of operation.

Mr. IKARD. I think, as you have already pointed out a while ago, the very nature of the animal is involved—one is a man that is a nonconformist and a man who rebels against the accepted, or he would not be a scientist; he is searching new fields and exploring new avenues, and the military man is pretty much on the opposite side. It seems

to me there could conceivably be, just through the human element, considerable conflict between the two.

Mr. QUARLES. If there were not breadth of vision in their problems, and a very deliberate effort to get both sides to understand what it is, and to work it out, surely we would have the kind of conflict that you speak of.

Mr. IKARD. That is all.

Mr. RIEHLMAN. I wonder, while you are right on that subject, Mr. Secretary, that might be true at the upper echelon, but what about down in the working shop where you have some captain there over one project who has no particular background in research and development; never has had any scientific training of any kind? Suppose that he exerts his military authority down in that level? That is where you are probably going to find more dissension than you would at the top level. I think that the colonel at the top would be very apt to try to bring about coordination and understanding, but when you get down into the field where they are actually doing the work in the laboring part, and you put in some boy who has been brought in from an entirely different field of activity, you see, who has no particular background but the Army, the Navy, or the Air Force—he is dropped in there and given an assignment for 2 or 3 years—maybe that boy with 1 bar or 2 bars on his shoulders might try to carry out the military discipline and order. I just wonder what experience you have had along that line, if any at all.

Mr. QUARLES. Generally speaking, in such an establishment, the colonel at the top—to illustrate the point—has a scientist opposite him in charge of the whole area of scientific work. We do not have a captain down here [indicating] in charge of a group of scientists. I know of no case where there is that pattern. You have the colonel here [indicating], and the scientist here [indicating], and you have scientists and scientific organizations below.

Mr. RIEHLMAN. No military?

Mr. QUARLES. You do not have a captain coming over here under this colonel to cover some part of this area [indicating].

Mr. RIEHLMAN. No military influence at all at that level?

Mr. QUARLES. Military influence through the top, but not in the nature of direct control across.

Mr. RIEHLMAN. I see.

Mr. QUARLES. There are cases where we will have a captain who knows how to do this kind of work and who will come in and take off his uniform and work in the organization just as though he were a part of it, but he is not reflecting military control. He is working then as a technical man.

Mr. COTTER. Then, your scientific research and development setups are not like your procurement setups where you have the military organization all the way to the bottom? You do not have each branch having a military administrative officer; is that correct?

Mr. QUARLES. Not each branch of a laboratory.

Mr. COTTER. Each branch of an organization of a laboratory, does not it have some sort of military commander?

Mr. QUARLES. I know of no case where it does. The general pattern in a laboratory, or in a developmental center is to have a chief scientist at the top of it, and then to have a scientific organization under him.

Mr. COTTER. Just completely civilian with the exception of the scientific officer, you say, working in his plain clothes.

Mr. QUARLES. That is right.

There are test centers which are not really laboratories in the ordinary sense, and in which the subdivisions of the test center will have an officer in charge of a line of tests. So one has to be a little careful in answering the question.

Mr. COTTER. As you get over into the developmental stage, you get that picture. You are talking more of the research stage; is that right?

Mr. QUARLES. I am talking about research and development, but I am not including organizations that are really service organizations to bring things in and test them and send them back again. That kind of an operation may have more of a military character.

Mr. COTTER. The scientists working in that sort of test project gets more military regimentation than in your real laboratory?

Mr. QUARLES. He might very well.

Mr. MCCORMACK. Do you have anything to say about which commanding officer will be assigned to a particular laboratory?

Mr. QUARLES. Only in a very informal way. That we regard as a military department responsibility. They have frankly in an informal way consulted me about the matter, but never recognizing I have any authority in the matter.

Mr. IKARD. Let us suppose that there is one of these rare ones that we have been talking about where you do have a conflict, what authority would you have to get rid of the military man if you felt that you should? Is that an informal thing? You have no direct authority, do you?

Mr. QUARLES. I do not. When these things kick upstairs, as we say, we work them out amongst ourselves without my asserting any authority in the matter. Nobody needs to be told what to do. We are all looking for the best solution that we can find.

Mr. MCCORMACK. We have in the Army the Corps of Engineers, the Quartermaster Corps, the Ordnance Corps and the Medical Corps. You have your officers and your civilians working. What would be your thought on a research and development corps where the men would make it a career?

Mr. QUARLES. The Ordnance Corps, for example, is itself two things—a research and development corps and a procurement and logistics corps, warehousing, and so on. I would not like to see us have a research and development corps covering ordnance and the Signal and the Medical and Quartermaster and all the rest and then a separate Ordnance Corps procuring and warehousing and maintaining. I think the kind of thing we now have in which research and development is brought together with procurement and warehousing and the whole supply function is a better way to handle that.

Mr. MCCORMACK. I have no opinion. I just simply asked the question because it came to my mind.

Now, Mr. Secretary, I happened to be a buck private when I was in World War I, and I am proud of that fact.

Mr. QUARLES. You may very well be.

Mr. MCCORMACK. Now, the lower echelon of officers have no military control or direction. I might go one step further—do they undertake to assume military control and direction over the scientists?

Mr. QUARLES. That is a hard question to answer categorically. I would like to illustrate it. At Inyokern, for instance, there is one scientific director and there is one naval captain in command of the post. There are other naval people under that captain, but a naval commander, or a lieutenant, for example, might be in charge of all the maintenance functions on the post; another might be in charge of all of the security personnel on the post and so there are functions that are assigned to subordinate military people. But the chief scientist has under him only other civilian people, or at the most, military people who are working as civilian people and as a part of the organization.

Now, that is the normal pattern, but there are, to be sure, variations on that.

Mr. MCCORMACK. I asked you a question earlier and I would like to pursue it a little further. What has been the turnover of scientists in the last 2 or 3 years in the government engaged in military work? Have you had that information?

Mr. QUARLES. I think I have quite a complete answer to that, Mr. McCormack. Maybe it would satisfy you better to have me take that up later.

Question. Does the military organization have a research and development program to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?

Answer. It is important, of course, that military and scientific groups appreciate that they must work as partners to achieve success. Each must recognize the experience, function, responsibility, and prerogatives of the other. Uniformed men because of their training and experience have an unusual respect for authority and tradition, while the atmosphere of creative scientific effort has always allowed the constant questioning of established ideas and practices. It is my opinion that the extent to which frictions arising from such dissimilar points of view retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientists and technical personnel is local and limited rather than general.

Later questions bring out more of the same.

Mr. RIEHLMAN. Why don't you proceed and finish this, and we can make any notations on the question.

Mr. QUARLES. I think that would be a good idea.

3. Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?

Since World War II a number of proposals have been made for the establishment of a civilian organization to administer military research and development programs at the Department of Defense or the military department levels. The advocates of these plans have claimed as their advantages that centralization would increase efficiency and would help eliminate undesirable duplication. None of these plans has ever been given general support by the legislative or executive branches of the Government. Although such a plan may have considerable merit and although such a scheme has been working satisfactorily in Britain for some years, I have never supported and do not support a change to such a system.

Mr. BALWAN. You have not included the Canadian plan here, which is at the other end of the spectrum from the British plan. Have you ever entertained that, since that is not mentioned here?

Mr. QUARLES. Yes, I would say that we have entertained it and we still hold our system of decentralizing this function as much as possible, putting it down in the place where the problems they are trying to solve are best understood. It is our feeling we gain more by that kind of decentralization than we could gain by pulling it together. In effect, when you pull this together, let us realize that you may be just transferring from a lower echelon to an upper echelon the problem of tying in the military point of view with the civilian point of view. Sooner or later, you have to bring those things together If you bring them together down here where the problem is understood, it is our feeling that you get the most effective tie-in, the most effective coupling of the scientists to the problem they are trying to solve.

Mr. BALWAN. It might be well at this point for those not familiar with the Canadian plan to know a little something about it. I am not familiar with it myself, but I understand it is a system whereby they have almost a fourth service devoted to research and development in which the director of that research and development department sits in as a member of the Joint Chiefs of Staff in Canada. The research and development program is strictly a civilian program. The military officers that are assigned to it are there for training purposes, but in addition to that I understand that the military departments do carry on some of their own research which is related to the civilian organization.

Mr. QUARLES. I think they carry on more what we in this country call development of gear that they are interested in.

The Canadian system is patterned fairly closely after the British Ministry of Supply. After the war the British pulled it together, pulled together everything except what they called their admiralty work for the Navy, but including aircraft for the Navy. They are all pulled into the British Ministry of Supply.

One must constantly bear in mind the fact that the objective of the military research and development program is to provide new and improved military equipment, weapons and techniques. It is essential that there be complete understanding of the military needs by the persons administering and conducting the research and development programs. There must be continual interaction between the users and the developers. It is the purpose of the present organizational setup to take maximum advantage of both military and civilian contributions. There is a basic danger in attempting to separate the administration of all military research and development in a civilian organization in that in an attempt to obtain greater efficiency of operation we may sacrifice our ability to produce the new types of weapons which are needed and would be used by the military. Although there are at times differences of opinion among military and civilian personnel connected with the program, the solution of the problem is not to try to separate them but rather to get them to work cooperatively at all levels from that of top policy formulation down to program execution at the installation level.

4. Would it be feasible to organize military research and development programs in such a way that the technical activities, capable of

being performed by a civilian organization could be separated from those which are purely military, such as support functions? Where military support activities are necessary in connection with a research and development project, and such activities must be under a military commander, does it necessarily follow that the technical research and development functions must also be under direct military supervision?

To a large degree, this separation of technical activities from military functions is accomplished by virtue of the large percentage of the program (approximately two-thirds as is discussed in a subsequent paragraph) which is actually being performed under contract by private industry, universities, and nonprofit organizations. The remaining funds are spent in military installations which, I believe, are necessary to: (*a*) Test and evaluate equipment developed under contract; (*b*) conduct research and development in fields where it is difficult to obtain proper facilities in industry; and (*c*) maintain technical competence in the various scientific fields.

There are approximately 100 major "inshop" military research and development organizations now in operation, and the function of these individual establishments varies widely; therefore, the organization at each of these establishments must be individually tailored to carry out the assigned mission. I might say that the idea of separating technical and support activities at military installations is presently in operation at two of the major Air Force test stations where the technical operation of the station is under contract with private organizations and the support functions are the responsibility of the Air Force personnel assigned to the station.

Mr. BALWAN. Might it be proper to ask what two?

Mr. QUARLES. The Patrick Air Force Base is one, where the Air Force has just recently put the operation on a contract basis within the last year, and the Arnold Engineering Development Center at Tullahoma, Tenn.

While there is no assurance that successful operation of this type at a test station would guarantee equally successful operation at a research and development station, nevertheless, the operation of these stations is being carefully watched and the lessons to be learned will be applied to the administration of other stations wherever possible.

5. To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs? To what extent should private, nonprofit institutions participate. To what extent should private industry participate? How much "in-house" research is required for the military services to be capable of exercising qualitative control over research and development by outside laboratories?

In general, the distribution of research and development funds among industry, Department of Defense, laboratories, universities, and nonprofit institutions is governed by the following policy:

(*a*) On the whole, we look to industry for the development and design of items that must meet specific and well-defined military characteristics or qualitative requirements. Private industry with its wealth of experience in the design and production of new products, many of which are very similar to the items required by the military, is our primary source of support for the Department of Defense research and development program.

(*b*) Department of Defense facilities, either Government operated or contractor-operated, are necessary to a lesser extent to perform certain functions which it is not practical for industry to assume. For example, certain development and test programs require such expensive facilities or are of such a hazardous nature that Government sponsorship is necessary.

Also, in the field of systems engineering and in the development of very unique military-end items, which require close coordination with the military users, it is necessary to perform a large portion of the development at Government facilities. In addition, it is necessary for the military departments to carry on a certain minimum program of supporting research to create and preserve a science-oriented group of personnel needed to carry out the Government's coordination and evaluation of the research and development being performed by industry and nonprofit organizations.

(*c*) The universities and nonprofit institutions are the primary source of the basic supporting type research needed to balance the overall Department of Defense program of research and development. It is realized that some end-item development work is now being conducted in these organizations, but it is felt that the long-range trend should be to eliminate as much of this type of work as possible from, especially, those institutions where education and the advancement of fundamental science are the primary mission. The role of the nonprofit laboratories is not quite as definable, as there are instances where, because of unique facilities or availability of a singularly qualified staff, it may be more expeditious or economical to rely on these laboratories for certain end-item developments; however, it is felt that these exceptions should be kept to a minimum and that the primary contribution of these laboratories to the Department of Defense program should be in the area of supporting research.

Mr. BALWAN. In order to clarify one point here that may not be clear to the members, with regard to the role of the nonprofit laboratories, are we referring to such institutions as the Rand Corp.?

Mr. QUARLES. The Rand Corp. is scarcely a laboratory in my definition, so let me give you what I regard as a better illustration.

The Stanford Research Institute is an illustration of a nonprofit laboratory. The Lincoln Laboratory operated under the Massachusetts Institute of Technology is another illustration.

Mr. BALWAN. And Brookhaven.

Mr. QUARLES. That would be such an example, but it is operated under the Atomic Energy Commission rather than the Department of Defense, but those are the kinds of laboratories to which I refer.

The distribution of the direct research and development funds for fiscal year 1955 among the various types of organization is as follows: Industry, 57.1 percent; Department of Defense facilities, 31.7 percent; universities and nonprofit institutions, 9.9 percent; other Government agencies, 1.3 percent. This distribution should change gradually. The percentage of the work done in universities and nonprofit institutions should tend to decrease as hardware-development work shifts from universities to industry. To be effective the Department of Defense facility level should be as stable as possible, but should not increase although its percentage of the total program may change.

REPORTED PROBLEMS IN MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

I. Civilian scientists in military research and development centers are reported to be generally dissatisfied with military domination and administration.

Mr. McCormack. What is the main reason for shifting from universities to nonprofit institutions and to private industry?

Mr. Quarles. We think the hardware-development work carried on in the universities is scarcely compatible with the main university function, and we find that the universities themselves, feeling that they should get out of that kind of work, want to get out of it, and it is our feeling that we should work them out of it as we can get industry to take it over.

Mr. McCormack. Is there also a feeling on the part of the universities utilized that they should not lose their primary function of education?

Mr. Quarles. Exactly.

Mr. Balwan. These problems, as the chairman pointed out in his opening statement, are merely working hypotheses in the committee. In our letter he asked you for your reactions to them. We are not accusing the Defense Department of anything or saying this is so, but this is the kind of thing around which we have to work.

Mr. Quarles. We interpreted them just that way.

I am not aware of any general dissatisfaction with the military administration of military research and development installations. When you take any group of 20,000 people you are bound to find some persons who are dissatisfied with management whether it be a military or civilian organization. Studies which have been made regarding the attitude of scientific persons and engineers toward their employment in military laboratories have indicated that some dissatisfaction stems from the military-civilian relationship but it is not the predominant factor. More frequently reported as the basis for dissatisfaction have been inadequate compensation; lack of opportunity for advancement professionally; military security and Government rules and regulations. It is significant to note that roughly one-third of the engineers and scientists leaving military laboratories transfer to other military laboratories; another third accept employment in private industry; 25 percent return to colleges and universities for further studies and the remaining group leave Government employment for reasons of ill health, marriage, maternity, etc.

Mr. Balwan. I take it this is from a study or research that has been done for you?

Mr. Quarles. That is right. We have on a continuing basis statistics from the military laboratories about their personnel, and we were able to bring this material together from such statistical material as we have.

Mr. Balwan. Do you have any figures as to what the turnover has been in the last few years?

Mr. Quarles. The next question answers that. Shall I read it to see if it does?

Mr. Balwan. Please.

Mr. QUARLES (reading):

II. Civilian scientists are leaving military research and development centers in a general exodus.

There has been no general exodus of civilian engineers and scientists from our military research and development installations. The annual rate of separation for research engineers and scientists in military laboratories is approximately 15 percent. A survey of scientific research and development in American industry conducted in 1952 showed that the annual separation rate for research engineers and scientists averaged 16.4 percent for all industries at that time. These statistics, however, do not tell the whole story. We do have a real administrative problem since we continue to lose some of our best qualified and most capable scientists and engineers and are unable, in many cases, to provide sufficient inducement to get equally capable men to replace them.

Mr. BALWAN. On that point, is it true probably the turnover would be 15 percent considering all engineers? Take a laboratory like the Cambridge Research Center, which has people anywhere from the Public Law 313 class down to GS–11's, 10's, and even lower than that: Has any study been made which analyzes the amount of turnover of the top important civilian personnel, say among the Public Law 313's, the 16's, the 15's, and the 14's, who would probably be chiefs of sections or directors of directorates, or technical directors, or chief scientists even.

Mr. QUARLES. I do not have such statistics available. They could be made available, of course. The difficulty there is in the defining your terms. You might lose a GS–14 and it would actually be a greater loss to the organization than a Public Law 313 from the top of the organization. It is very difficult to define the terms. I agree with your point, we tend to lose the cream in this operation rather than the milk at the bottom.

Mr. BALWAN. I think the question was probably designed because the preliminary inquiry by the staff revealed that the people who are leaving are the top scientists in a very limited number of cases, and it is not entirely representative of the whole Department of Defense.

I wonder, Mr. Chairman, if it might not be a reasonable request to ask for such an analysis with regard to the top civilian scientists, limiting to the Public Law–313, the 16's the 15's and the 14's. I guess Public Law 313 as passed in the 80th Congress permitted the Department of Defense to set up certain scientists at grades above those allowable by the Civil Service Commission; is that right, Mr. Secretary?

Mr. QUARLES. What we call the superservice grades, and they are grades 16, 17, and 18 in the GS grade, and then we have the P–9 legislation, which permitted supergrades in that category.

Mr. BALWAN. Could we ask for an analysis like that?

Mr. RIEHLMAN. I think the Secretary has suggested that he would be able to get it if we give him the proper information and tell him exactly what we want.

Mr. QUARLES. Yes.

(The information requested is as follows:)

TURNOVER RATE FOR SCIENTISTS IN TOP POSITIONS

In response to the request for information regarding the top civilian scientific positions and the annual turnover rate, a survey was conducted which revealed that there were 91 scientific positions last year in the Department of Defense which came under the GS–16, GS–17, GS–18, and Public Law 313 categories; a total of 15 scientists left these positions last year resulting in an annual turnover rate of

16.5 percent which compares favorably with the annual turnover rate of 15 percent for all engineers and scientists employed in military laboratories and the annual turnover rate of 16.4 percent for engineers and scientists employed by industrial research and development laboratories. It should also be noted that many scientists accept these top-level Government positions with the definite understanding that they will return to their regular civilian occupation after a predetermined period of time, and this of course tends to increase the annual turnover rate.

Below are given the definitions for these top positions as contained in Public Law 313, 80th Congress, and Public Law 429, 81st Congress, the statutory salaries, the present distribution of the positions, and a breakdown of the reasons for resignations. (Information on the first two items was requested in subsequent paragraphs.)

DEFINITIONS

GS–16 includes all classes of positions the duties of which are (1) to perform, under general administrative direction, with unusual latitude for the exercise of independent judgment, work of outstanding difficulty and responsibility along special technical, supervisory, or administrative lines which has demonstrated leadership and exceptional attainments; (2) to serve as the head of a major organization involving work of comparable level; (3) to plan and direct or to plan and to execute professional, scientific, technical, administrative, fiscal, or other specialized programs of unusual difficulty, responsibility, and national significance, requiring extended training and experience which has demonstrated leadership and exceptional attainments in professional, scientific, or technical research, practice, or administration, or in administrative, fiscal, or other specialized activities; or (4) to perform consulting or other professional, scientific, technical, administrative, fiscal, or other specialized work of equal importance, difficulty, and responsibility, and requiring comparable qualifications.

GS–17 includes all classes of positions the duties of which are (1) to serve as the head of a bureau where the position, considering the kind and extent of the authorities and responsibilities vested in it, and the scope, complexity, and degree of difficulty of the activities carried on, is of a high order among the whole group of positions of heads of bureaus; (2) to plan and direct or to plan and execute professional, scientific, technical, administrative, fiscal, or other specialized programs of exceptional difficulty, responsibility, and national significance, requiring extended training and experience which has demonstrated exceptional leadership and attainments in professional, scientific, or technical research, practice, or administration, or in administrative, fiscal, or other specialized activities; or (3) to perform consulting or other professional, scientific, technical, administrative, fiscal, or other specialized work of equal importance, difficulty, and responsibility, and requiring comparable qualifications.

GS–18 includes all classes of positions the duties of which are (1) to serve as the head of a bureau where the position, considering the kind and extent of the authorities and responsibilities vested in it, and the scope, complexity, and degree of difficulty of the activities carried on, is exceptional and outstanding among the whole group of positions of heads of bureaus; (2) to plan and direct or to plan and execute frontier or unprecedented professions, scientific, technical, administrative, fiscal, or other specialized programs of outstanding difficulty, responsibility, and national significance, requiring extended training and experience which has demonstrated outstanding leadership and attainments in professional, scientific, or technical research, practice, or administration, or in administrative, fiscal, or other specialized activities; or (3) to perform consulting or other professional, scientific, technical, administrative, fiscal, or other specialized work of equal importance, difficulty, and responsibility, and requiring comparable qualifications.

Public Law 313: These positions are established in the professional and scientific service, each such position being established to effectuate those research and development functions relating to the national defense, military and naval medicine, and any and all other activities which require the services of specially qualified scientific or professional personnel.

Statutory salaries

GS–16	$12,000 to $12,800
GS–17	$13,000 to $13,800
GS–18	$14,800
Public Law 313	$10,000 to $15,000

Distribution of Public Law 313 and supergrade positions in Department of Defense research and development organizations

Position category	*Number of positions*
Army:	
GS–16	9
GS–17	5
GS–18	1
Public Law 313	13
Total	28
Navy:	
GS–16	19
GS–17	2
GS–18	0
Public Law 313	13
Total	34
Air Force:	
GS–16	5
GS–17	2
GS–18	0
Public Law 313	12
Total	19
Office of the Secretary of Defense:	
GS–16	2
GS–17	3
GS–18	0
Public Law 313	5
Total	10
Grand total	91

Summary of vacancies created in Public Law 313 and supergrade positions in the last year

(Purely administrative changes have been omitted)

Total number of positions available	91
Total number of vacancies created in the last year	15
Reasons for resignations:	
Incumbent retired	3
Incumbent transferred to another military research and development organization	3
Incumbent transferred to another Government organization (non-Department of Defense)	2
Incumbent was on leave of absence from a university and returned to the university	4
Incumbent transferred to industrial organization	1
Reason unknown	2
Total	15

Mr. BALWAN. Could we have what the specifications are for the Public Law 313 and also the salary?

Mr. QUARLES. The Public Law 313 is the law which establishes the super-grades. The supergrades are the GS–16, 17, and 18 positions, or the P–9. Of course, we can give you salaries associated with those grades.

Mr. RIEHLMAN. And what the qualifications should be to fill those jobs. Is that what you have in mind?

Mr. LIPSCOMB. Yes.

Mr. MCCORMACK. Mr. Secretary, it is my understanding that it takes years to really develop a trained and efficient military scientist; is that so?

Mr. QUARLES. It does indeed; yes.

Mr. MCCORMACK. And when one goes another has to be employed. So you lose all that experience, and then there is the cost of the transfer, so it is vitally important to keep the men in service as long as possible, and if you could do so it would be a big money saver for the Government and the taxpayers; is that correct?

Mr. QUARLES. It certainly is.

Mr. MCCORMACK. Now, I notice an observation that you have just made—that it is more frequently reported the basis of dissatisfaction is the inadequate compensation. Will you give your views on that to the committee as to what effect it has and what you think should be done to correct it, if you think anything should be done, of course?

Mr. QUARLES. As you realize, the compensation of technical personnel is controlled by the civil-service grades, and the statutory salaries attaching to those grades. At the time the legislation was passed, I think those salary levels were reasonable and gave the Department a reasonable competitive position in the technical-labor market. With the great step-up in demand for this kind of talent the market has been inflated and we are left in an unfavorable position in the market to hire people for this kind of work. So, what at one time was thought to be liberal salary is no longer competitive salary to get top-grade people.

There are top-grade people who are willing to continue on at these salaries for personal reasons. I do not imply we do not have top-grade people, but I do imply in a straight market sense the salaries are not competitive for the top-grade people.

Mr. MCCORMACK. In other words, where one is confronted directly with the economic situation of supporting his family and making sacrifices for his country, and so forth, he is faced with a pretty serious problem.

Mr. QUARLES. He is, and that situation certainly calls for thought and certainly causes us to lose some substantial fraction of this 5 percent a year of our people who go from our laboratories into industry.

Mr. MCCORMACK. Have you any suggestion to make in relation to that, or would you rather think it over and incorporate your suggestions later?

Mr. QUARLES. I would think that I should wait to reply to that question. We have Department of Defense requests before the Congress for liberalization of allowances as to the numbers of the higher grades we might have. I would prefer to relate my answer to those pending proposals.

Mr. MCCORMACK. Would you care to comment upon the lack of opportunity to advance professionally?

Mr. QUARLES. Within the Government, of course, the thing is fairly rigid as controlled by the civil service limitations, and Government scientists do not have as much opportunity to publish their work and get personal recognition as scientists working in universities and industry typically have. This kind of recognition is a big part of the compensation of a scientist, as you know, and a big part of his

professional standing, so that all of these things conspire to make it more difficult to achieve for scientists in Government employ the kind of professional recognition and advancement that he might well expect in civilian employ.

Mr. McCormack. Would you also care later, if you desire, to make a comment for the benefit of the subcommittee on that subject?

Mr. Quarles. I should be glad to.

(The information requested is as follows:)

The Federal Government is at a salary disadvantage in recruiting engineers both at the entrance grades and at the higher levels.

With regard to the lower grades, an inexperienced Government engineer normally is recruited at a salary of $3,410 per annum while the medium income for engineers in the lowest level of work, according to a professional engineers income and salary survey conducted by the National Society of Professional Engineers for the year 1952 is $4,700 per annum. From these figures it is readily apparent that if the Government desires to recruit beginners with potentiality for development, the inhiring rate must be higher for all or sufficiently flexible to allow selective recruitment based on qualifications as well as assigned duties.

Much will be accomplished toward elimination of the pay problems connected with the inhiring of young engineers if Congress will enact two measures now under consideration. One of these measures is the general readjustment of classification act pay scales proposed by the administration and the other is the administration-supported title I of S. 2665 which would provide authority to raise the inhiring rate for special classes of positions when necessary because of labor-market conditions.

With regard to the higher grades, the Government's competitive position is even worse than that as regards the starting grades. Recent statistics of the Civil Service Commission show that, since 1939, the salaries of GS–1 (then CAF–1) have increased 98.4 percent; GS–2, 91 percent; GS–5, 70.5 percent; GS–14, 47.7 percent; and GS–15, 35 percent. The lag in increases for the upper grades has caused the Government salaries to drop sharply behind industry and at the same time has lessened promotional opportunities in the Federal service. The Society of Professional Engineers' study referred to above indicates that the median income for engineers in industry steadily progresses with years of experience at a rate considerably above the normal progression rate of Government engineers. The difficulty which the Government has in recruiting and retaining competent engineers and scientists at the higher levels is illustrated by the following table from the Society of Professional Engineers' study showing the salaries paid by industry for positions comparable to Government engineering positions at the GS–13 level and above.

Median, quartile, and decile income 1952, by grade [1]

Grade	Lower decile	Lower quartile	Median	Upper quartile	Upper decile	Government inhiring	Government 3d pay step
GS–13	6,290	7,420	9,360	12,570	18,176	8,360	8,760
GS–14	7,320	8,930	11,630	16,770	24,820	9,600	10,000
GS–15	9,020	11,340	17,330	28,630	[2] 40,000	10,800	11,300

[1] The salaries supplied by the survey include Government engineers.
[2] Over.

The cited Government in hiring rates definitely limit recruiting potential. Neither do they recognize that position accomplishment at GS–13 and above is directly proportionate to the ability and experience of the incumbent.

Although Congress has partially alleviated these problems insofar as the Department of Defense is concerned by the establishment of a limited number of grades GS–16, 17, and 18 and of an even more limited number of Public Law 313 positions, the relief has been slight. With regard to supergrade positions Congress has authorized 200 such positions in the Department of Defense in the 1955 Appropriation Act, 20 more than the 180 ceiling established in the 1954 Appropriation Act. The increase is helpful, but a recent survey of positions considered allocable to supergrade levels showed that there are a minimum of 150 such positions in the DOD, in addition to the 200 currently authorized, which clearly

merit allocation to super grades. With regard to Public Law 313 positions, the DOD presently has authority to establish 45 such positions in research and development functions at salaries ranging from $10,000 to $15,000 per annum. This legislation has been helpful in meeting some of the needs for higher grade scientific positions but as indicated above, additional positions are needed. Accordingly, the DOD has sent to the Bureau of the Budget draft legislation which increases to a total of 114 the number of Public Law 313 positions available to the Department of Defense. The nature of the positions presently established under the authority of Public Law 313 and the qualifications of the incumbents are reported yearly by the Secretary of Defense to the Congress, as required by section 2 of that law, as amended.

Mr. McCORMACK. Now, military security in Government rules and regulations interests me very much. I think probably a good deal of your difficulty is there.

Mr. QUARLES. Military security is a factor.

Mr. McCORMACK. More Government rules and regulations.

Mr. QUARLES. May I just finish that one thought, that military security is a factor, because it limits publication and recognition in that sense. That is why professionally that is an important factor. As to Government rules and regulations, it is hard to be specific, but I think one scarcely needs to be. It is common knowledge that working within a Government establishment under the rules and regulations that the Government can lay down, involves rigidity and some degree of regimentation which individuals and particularly individuals of a scientific bent, tend to find irksome to themselves and which they tend to resent.

Mr. McCORMACK. Of course, the rules and regulations are promulgated as the result of existing law, organic law; is that correct?

Mr. QUARLES. That is right.

Mr. McCORMACK. Of course, rules and regulations must be promulgated following the law that some individual promulgating them may not thoroughly agree with.

Mr. QUARLES. Again, I am not prepared to speak to that question in its most general sense. I would like to lump that in with the other things because I think they all tie together and then we can see if we have recommendations for you in that respect.

Mr. McCORMACK. Now, this Committee on Government Operations in the House drafted the legislation which established the Central Intelligence Agency. We exempted the CIA from civil-service law, the agents, and so forth. I remember that I made the motion in the committee because I felt for many reasons that should be done.

What would be your views in relation to scientists on the same subject?

While it is undoubtedly true that many of our present problems could be solved by exempting scientists from the Classification Act, I do not feel that such action would be justified. I believe that the problems can be and should be solved within the general framework of civil service and that the suggestions given above constitute a much more satisfactory approach to the problem of adequate compensation for Government employees than exempting scientists or any other special group from the Classification Act.

Mr. QUARLES. I would like to give you a later answer to that question.

Mr. RIEHLMAN. Mr. McCormack, I think the Secretary will be very frank in doing that. I think he can give us his own personal views. Is that not what we are interested in?

Mr. QUARLES I would like to do it, but I would not be circumspect in doing it off the cuff.

Mr. RIEHLMAN. He will get a copy of the transcript, so he can answer the exact questions which you have propounded to him.

Mr. MCCORMACK. Together with any existing law which is unnecessary, which operates as a restriction, having in mind that we are dealing with a peculiar field of activities; an unusual and a very, very important one, in my opinion.

Mr. RIEHLMAN. I agree with you. I am very anxious to have those questions answered, because I have pondered over them some and I know they are very important.

Mr. QUARLES. They are, sir.

Mr. RIEHLMAN. There is no question about it.

Mr. MCCORMACK. Might I say that this is not anything of recent origin with me. I have taken it up a number of times with former President Truman. My interest in this goes pack at least 4 or 5 years.

The only desire I have, as we all have, is to get the maximum possible in the world of today with the world-killer mind that is challenging our way of life.

Mr. QUARLES. Nothing could be more important. I agree with you.

Mr. RIEHLMAN. Are there any other questions at this point? Might I ask the Secretary this: We would like to finish with you before 1 o'clock. If we could, if that is agreeable with you, then you would not have to come back.

Mr. QUARLES. I would appreciate it very much, if the committee would care to do that.

Mr. RIEHLMAN. We would care to, if it is agreeable with you.

Mr. QUARLES. Fine.

Mr. RIEHLMAN. We will proceed to try to finish with you before you leave.

Mr. QUARLES. All right.

III. When a military organization is imposed on a research and development program there is a tendency for the military to expand its control over technical decisions and operations in the research laboratories. We are asked to consider that thesis.

The management of scientific operations has never been easy and it is becoming increasingly complex and difficult. Military research and development must be oriented with respect to practicality and the real needs of the Armed Forces. However, overemphasis of this point may result in an inappropriate imposition of military control over technical decisions and operations. Since there is such a human tendency, management must be alert to signs of it and must take steps to counteract it.

Mr. BALWAN. May I ask a question, Mr. Chairman?

Mr. RIEHLMAN. Yes, if you would like, right now.

Mr. BALWAN. At this point, Mr. Secretary, the question I had was on this tendency for the military to come in and take control over technical decisions. I noted that earlier you mentioned the way the organization should be set up at the center level, the laboratory level, with a commanding officer, and opposite him a civilian director.

Do we have a set policy in the Department of Defense which stems from your office assuring that there would be that kind of organization?

Mr. QUARLES. Not precisely. What we have done is to discuss in our Policy Council, that I referred to in my testimony, the patterns of organization that the departments employ in various kinds of

establishments within each department, and we are in the process of giving that further study. But we do not have a statement of policy directing the three departments to behave in a particular way at this time.

Mr. BALWAN. We noted in reviewing some of the operations in military research and development that there were centers which operated in what appeared to be a very staisfactory manner so far as the personnel were concerned, such as the Naval Ordnance Laboratory.

Mr. QUARLES. Right.

Mr. BALWAN. Where there is a very clear understanding, it appears, between what the position is of the civilian scientist and the civilian technical director and that of the military people who handle the military aspects of the work. We noted that there were such characteristics within the Office of Naval Research, where the Naval Research Laboratory had a very definite understanding, and it is really a top grade organization.

We understand that within the Office of Naval Research there are two laboratories, one the Navy Research Laboratory and one the Navy Special Devices Center, operated under Admiral Furth. Whereas prior to the present commanding officer's tenure there was an organization similar to the Navy Research Laboratory, where the commanding officer had as his executive a military man handling military functions and a civilian director handling the civilian aspects, when the new commanding officer came in he changed the situation.

We are wondering whether there is need for assuring some kind of consistency even within these bureaus and departments which would permit a very clear understanding as to what is each person's function in such a situation, and if situations develop where this understanding is not apparent, is it your job to make that understanding apparent?

Mr. QUARLES. Your last part was a separate question. Let me speak to the other part first.

Mr. BALWAN. Yes.

Mr. QUARLES. If you look at the whole 100 establishments of this kind you find that they present a great range of mission. The Naval Research Laboratory, one might say, stands on one end of the spectrum. Then a missile-test center perhaps stands at the other end of the spectrum.

At the naval test center you have largely a service operation of getting the missiles in, the contractors bringing missiles in, setting them up for test, and so on. It is a matter of providing facilities for the tests and operating the range.

In general what is left to be done there may get to look like a military operation.

Now, our problem here is not to introduce an inflexibility into the system which would keep the people at each spot from adapting the organization to the kind of job they have to do. There is an essential difference between a Naval Research Laboratory at Anacostia and the Naval Special Devices Center on Long Island. There is an entirely different kind of mission at those two establishments.

We would like not to say to the man who goes up to take charge of the one at Long Island, "You must use the same organization they use at Anacostia."

It is that flexibility we are trying to avoid; but we are trying to develop a philosophy that will apply across the board here.

Mr. BALWAN. But within a center in which the mission has not changed there ought to be some consistency of operation, it would appear, so that the attitude of the new commanding officer does not reflect operations which would be applicable to another kind of mission.

Mr. QUARLES. Well, I think you will agree that on the contrary the new commanding officer, if he could make improvements in the organization, ought to do so. Maybe it has not been right in the past; maybe it should be changed.

I would not like to agree that a new commanding officer coming in cannot make any changes. But I would like to agree and would be glad to agree that he should not make changes in an irresponsible fashion.

I think it is true that no setups of that kind are changed without very careful consideration at higher echelons than that particular center commander.

Mr. BALWAN. Where they are changed are they called to your attention?

Mr. QUARLES. Not always. Not always.

Mr. BALWAN. Do you have jurisdiction in settling any such disputes?

Mr. QUARLES. Yes. I think, speaking very literally, the Secretary of Defense would have jurisdiction in settling any such disputes, but they would not get up to that level, unless there were something peculiar or special about them which forced them up to that level for settlement.

Mr. BALWAN. That answers my question, Mr. Chairman.

Mr. RIEHLMAN. Then naturally it would probably get to your level; is that correct?

Mr. QUARLES. Not unless the dispute were of a rather aggravated or special sort. They usually get ironed out at the departmental levels; for example, in the Office of Naval Research, Admiral Furth's office.

Mr. RIEHLMAN. Are there any other questions at that point?

Mr. MCCORMACK. I have asked you some questions, Mr. Secretary, about the ability of the commanding officers in the field of science. I would like to ask one more question.

Have you many commanding officers who are qualified in basic science, in the discoverable fields?

Mr. QUARLES. Not senior officers. I would say we do not have many. There are a number of junior officers who have doctors degrees and are in their own rights real scientists, but even there it is exceptional to find one who has the opportunity to pursue science in that sense.

Mr. MCCORMACK. Is that not important?

Mr. QUARLES. I think it is important, but I believe we cannot expect our uniformed officers to be themselves scientists. I think we have to bring that quality into our business through the civilian side, in general.

Mr. MCCORMACK. Did you have any comment?

Mr. BALWAN. Only an observation, Mr. McCormack.

We noticed where they did have a man who appeared to be a qualified scientist in the Air Research and Development Command, namely, Colonel Haywood. He is a man who was No. 1 in his West Poiut class in 1936. He got his masters and doctorate in the same year from Harvard and MIT respectively. He worked at Los Alamos, the Manhattan project; and recently was the Director of the Office of Scientific Research responsible to the commanding officer of the Air Research and Development Command. Three or four months ago he left the service. The service could not keep him.

He wrote quite an article in the Sunday supplement section giving his reasons for leaving. We probably will have him here. He is in industry now. He is gone.

This is an example; a good man developed in the military has left.

We have another man at the Rome Air Development Center. I do not know how qualified he is as a scientist, but at least Colonel Heavner has been there 2 or 3 years, and he now is being shipped to Korea on some kind of a tactical mission. We have a problem even within the military people to keep those in.

Mr. QUARLES. I think the colonel from Rome is a kind of typical case of rotation. The colonel resigning was a very special case. Since you are going to hear him I think I will let him tell the story.

This is the kind of thing that happens in the best of families. It happens in the Defense Department.

Mr. MCCORMACK. In this highly technical field have you any views as to whether or not the policy of the armed services—and I am talking about all branches—should be to have men devote their entire careers to the field of science? Of course, I am not talking about basic or applied or engineering; there are several aspects of science. When I say "science" I am talking about the whole field.

Mr. QUARLES. Right.

Mr. MCCORMACK. Involved in that is the question of promotion. I can see that if I were in the Army and I were assigned and because of that assignment I was going to be denied the opportunity of promotion it would be important. Whereas if I took an assignment in the Infantry or in the Air Force which is quite desirable, they tell me, the opportunity of going ahead would be greater.

As a matter of fact, your Corps of Engineers is faced with a serious problem, I understand, where the men have always been the top graduates of West Point who wanted to go into the Engineers, but they do not now because the opportunity for advancement is limited. That has nothing to do with this inquiry, but that has a relationship to my inquiry about the opportunity for advancement, which is only a natura' thing.

Mr. QUARLES. Right. The Navy, as you know, has its "engineering duty only" officers who do specialize in and make careers of engineering-duty assignments of various kinds.

The Army has its technical corps, and while that is not rigid a Signal Corps man tends to stay in signal work and an Ordnance Corps man tends to stay in ordnance work, and his advancement is through those technical corps.

So I think in both of the two older services there is the kind of engineering-duty specialization you speak of. The Air Force at the present time has not formalized an engineering-duty assignment,

although the Air Force is progressively bringing more and more highly competent scientific and engineering people into uniform and is building up its competence. So far it has not formally designated a certain group of them as engineering duty only officers and a certain other group as flying officers.

Mr. McCormack. I was talking about the Corps of Engineers, where the man follows a straight career. Of course, that opens up another question we will not go into, because the question might later arise, at whose expense is that going to be? It may be at the expense of the Army Engineers. That is another day and that is another question.

The thought in my mind is this: What effect does this rotation have on this vitally important field? In my opinion there is none more vital. There is a question of getting teamwork; not one dominating the other, but, as you well said, a partnership or a teamwork.

What is the best way from a human angle? None of us are perfect, but how can we approach perfection as nearly as possible? Perfection of administration; perfection of operation; perfection of activities in the various fields of science—to get the maximum results. Is rotation of officers consistent with that, Mr. Secretary?

Mr. Quarles. I feel that rotation of officers is an essential part of the uniformed scheme of things.

Mr. McCormack. Take the field of science. Is it an essential part of the field of military science, in your opinion?

Mr. Quarles. I think it is an essential part of the field of science, if you will allow me to include in your question the assumption that we will have civilians brought into the organization to perform the essentially professional scientific roles rather than depending on our uniformed people to perform those roles.

Mr. McCormack. Of course, that is implied by my question. I am talking about the uniformed men and the civilians working as a unit, as a team, in connection with the obtaining of the maximum degree of results. Military officers have to be there, do they not?

Mr. Quarles. Yes.

Mr. McCormack. We will take that group. Rotation of those military officers is now anywhere from 1 to 3 years. Is that consistent with the maximum development in this important field, the maximum development humanly possible?

Mr. Quarles. I think it is not consistent with the maximum development in this field taken apart from the whole military mission, but I think it is consistent with the optimum performance of the military mission as a whole.

Mr. McCormack. Now, on May 27, 1953, I made a speech on the floor of the House. It was simply another effort to try to help out. I had introduced a bill for the Assistant Secretary of Defense, and also the Assistant Secretaries of the Army, Navy, and the Air Force.

I think my bill was introduced before the reorganization.

Mr. Quarles. Before the reorganization bill.

Mr. McCormack. I do not know whether I had anything to do with it or not. But I made a speech and I enumerated certain things. This was no criticism. Have you read that?

Mr. Quarles. No, sir; I was out in New Mexico with the atomic bomb tests at that time.

Mr. McCORMACK. I take no great pride in it. I thought it was a situation which, for the best interests of the country, required something to be done. No criticisms were there.

I said,

First. There are insufficient provisions at the defense level for coordinating the work of the Army, Navy, and Air Force in this field.

Mr. QUARLES. Speaking of research and development?

Mr. McCORMACK. Yes. Have you any comment to make on that?

Mr. QUARLES. As of that time I think your statement was correct.

Mr. McCORMACK. As of now will you give us the benefit of your views?

Mr. QUARLES. As of now I feel that there are sufficient provisions for this coordination.

Mr. McCORMACK (reading):

Second. There are no qualified scientific administrators at the Assistant Secretarys' level of the Army, Navy, and Air Force with sufficient responsibility and authority to operate and control scientific research projects.

This was May 27, 1953.

Mr. QUARLES. Again, I think that your point was well taken. There were exceptions to your statement, but as a generality I think it was well taken.

Again, I think that situation is being corrected by pending legislation which will create additional assistant secretaryships in the military department.

Mr. McCORMACK. Is that two more?

Mr. QUARLES. Two more in each.

Mr. McCORMACK. Will they be research and development?

Mr. QUARLES. Not specified by law, but it is my understanding that it is intended to make one such.

Mr. McCORMACK. I thought one was going to be a comptroller.

Mr. QUARLES. I think it is planned that one will be a fiscal officer.

Mr. McCORMACK. That is some advance along my line.

Mr. QUARLES. Exactly.

Mr. McCORMACK. You will not mind when it comes up if I try to get one for each branch?

Mr. QUARLES. No, sir; I will not mind. However, I think it is true that present plans are to create two for each department, one of whom will have this function.

Mr. McCORMACK (reading):

Third. Military research activities within the Army, Navy, and Air Force and the civilian scientists who either direct the work or are engaged actively in research, are subject to the laws, regulations, and controls established by Congress and the departments to control troops, operate a base or fleet, or purchase supplies and materials.

Is that correct?

Mr. QUARLES. That is a factual statement; yes, sir.

Mr. McCORMACK. Is that a factual statement today, too?

Mr. QUARLES. Yes; I think it is a factual statement today.

Mr. McCORMACK. Do you think any changes should be made there in relation to the field in which the subcommittee is inquiring?

Mr. QUARLES. In a legislative sense I would not have that opinion; that there should be legislation to change that situation.

Mr. McCORMACK. You think there should be?

Mr. QUARLES. I have the opinion that there should not be legislation to change that.

Mr. McCormack. You think administratively it can be done?

Mr. QUARLES. Yes, sir.

Mr. McCORMACK. I see. [Reading:]

Fourth. Civilian military scientists employed by the Army, Navy, and Air Force are subject to civil service regulations. There is no way whereby these services can offer special inducements to obtain badly needed experts and there is no way the departments can reward a scientist for outstanding accomplishment or provide a strong incentive to accomplish a given end.

You have covered that already.

Mr. QUARLES. That is one of my points. Yes, sir; I did.

Mr. RIEHLMAN. I wonder: Have you looked over the rest of these questions?

Mr. LIPSCOMB. Yes.

Mr. RIEHLMAN. Mr. McCormack, do you have any questions on the rest of the questions asked of the Secretary? I wonder if we could insert the rest of the questions and answers in the record. Then if we need to study them further we can do that.

(The balance of the prepared statement is as follows:)

IV. Military research and development officers are not scientists who command the respect of the civilian scientists.

In most cases, with notable exceptions military officers at research and development establishments make no pretense of being scientists. Nevertheless many of them are respected by their civilian colleagues because of their military attainments, sound judgment, administrative ability and other valuable qualities. It is a fallacy to believe that one necessarily need be a scientist in order to have the respect of scientists.

V. The policy of rotating assignments for military officers militates against the retention of officers who in some cases have the training, talents, and disposition to guide scientific research centers.

The policy of rotating assignments for military officers does sometimes deprive a research center of the talents and training of an officer with special aptitudes for management and guidance of research programs for more than a limited period of time. It is believed that the ill effects of this policy may be considerably relieved by giving an increasingly greater share of the responsibility for administrative management, as well as technical direction, to civilian scientists who can provide the element of continuity. The inclusion of these men in the top policy-making group, where they can furnish judgment in the detailed consideration of plans and programs, will go far to provide stability and continuity to the research effort.

VI. Research centers often are organized and administered as military organizations with the attendant restrictive forms, procedures, regulations, and military discipline which do not provide the optimum climate for research work by civilian scientists.

A tendency is frequently encountered to ascribe excessively restrictive forms, procedures, regulations, and strict discipline to military organizations exclusively. While it is undoubtedly true that such characteristics do not provide the optimum climate for research work by civilian scientists they are by no means found only in military organizations—nor for that matter in Government agencies. What is needed is constant vigilance on the part of those responsible to see that the restrictive and demoralizing forces of bureaucratic organization are kept to a minimum.

VII. The lack of either a definite or consistent policy for organizing and administering research and development centers leaves each center at the mercy of each change in commanding officers and executives. This creates an instability with no assurance that even the well run research and development center will not become, with a change of officers, an unbearable situation.

All three military departments have developed frameworks of policies and procedures within which the research centers are expected to operate consistently. Detailed implementation of the policies and procedures are, however, left to the operating heads of the centers. In this context, each research center is vulnerable

to changes in the detailed operating procedures which may be brought about by each change in its commanding officer. Here again, however, is a shortcoming that is not peculiar to the military, nor even to Government. The many disruptions usually encountered when there is a change at the top of most civilian agencies is too well known to require elaboration.

The problem of accomplishing effective military research and development, therefore, is essentially one of achieving farsighted and coordinated planning, programing, distribution, management, and administration of the effort within a framework of controlling policies and regulations, yet with proper regard for essential elements of the scientific method. Where the governing regulations conflict unnecessarily with the requirements of scientific progress responsible levels of the military command must bring about the necessary changes in policies and rules. Further, all levels of responsible Government management must remain alert to possibilities for improving the administration of scientific effort leading to the development of new or improved weapons, equipment, systems, and techniques of potential military value.

VIII. Several outstanding civilian scientists who have been associated with military research and development programs are reported to be in favor of changes in the governmental organization and administration of these programs.

I am not personally aware of any major new proposals from outstanding scientists for changes in the Government organization and administration of these programs. However, I do feel that we should give consideration to any proposed changes which offer a high probability of increasing our efficency and improving our output.

IX. The funding of research and development is confused when handled with military budgets. Direct research and development costs are justified to and appropriated by the Congress as such. However, this does not give a true picture of the actual total cost of military research and development programs inasmuch as there are substantial indirect costs arising from military support functions in the form of pay for uniformed officers, provision of capital facilities, and certain maintenance and operation expenditures.

In this connection, it is reported that it is often felt necessary to build up a research and development center with such support functions in order to make it respectable in terms of size and complexity as a command for a colonel or general. This, in turn, sets off a vicious cycle in that the existence of military support elements becomes a further excuse for military domination, more officers, regulations, etc.

I have already touched upon these two problems in my answers to earlier questions but I might add a few words about them. As far as the funding situation is concerned it is certainly true that one must consider more than the direct research and development costs if he wants to get an accurate picture of the total cost of research and development. However, a number of steps have been taken to help clarify this situation. For several years the Department of Defense in submitting its budget to Congress has included in its category breakdown the total of both the direct research and development costs and total of identifiable indirect costs. In addition, the Secretary of Defense has established a special committee to look into the entire budget and financial system of the Department of Defense in order to provide better information for management decisions. It is understood that this committee has about completed its studies and will be submitting its report and recommendations in the near future.

As far as the empire-building problem is concerned I must admit that it is a tendency which I have seen among military personnel, civil-service personnel and plain civilians. Management must watch for it and counteract it. Under the many management pressures for increased efficiency and the elimination of unnecessary activities it is becoming more and more difficult for empire builders to have much success.

That concludes my specific comments on your questions and the reported problems. I would like, however, to summarize my reactions to them in order to make my position somewhat clearer. I have noted that most of the issues and problems seem to center around the civilian-military relationship in the administration of the Department of Defense research and development program and to the administration of the in-shop work in our research and development establishments. There are about 100 of these establishments in operation at the present time which are headed by military officers and staffed by military and civilian personnel. I believe that the majority of these establishments have arrived at a reasonable balance and understanding among the military and civilian personnel and are operating effectively. However, in the past year, there

have been more reports of dissension from a few establishments than there should have been. Investigation has revealed that most of the disagreement stemmed from local problems which required special solution in each individual case. I have come to the conclusion that there was no general procedural or organizational policy change which would have averted these differences of opinion. We must simply realize that a problem does exist and take effective action on a case-by-case basis as undesirable situations develop.

Mr. RIEHLMAN. Before we close the hearings, Mr. Cotter, do you have any questions?

Mr. COTTER. I think I have three, if you would like to have me ask them.

Mr. RIEHLMAN. I would be glad to.

Prior to that I want to recognize Mr. Murray Jackson, who is here this morning. He is the chief investigator for the full Committee on Government Operations, and Mr. Hoffman asked him to come over this morning. I have not had the opportunity to see very much of him in the full committee. The chairman must have kept him pretty active somewhere else.

We are happy to have you over here, Mr. Jackson. We are delighted you can be here with us. Any time you can sit in we would be glad to have you with us.

Secondly, if you have any questions at all we would be glad to permit you to ask them at any time during the hearings, or when we have concluded with the regular members' questions.

Mr. JACKSON. Thank you, Mr. Chairman.

Mr. RIEHLMAN. Yes, sir.

Mr. QUARLES. Off the record, please.

(Discussion off the record.)

Mr. RIEHLMAN. Mr. Cotter?

Mr. COTTER. In your general comments with respect to integrating research do you have any general overall policy with respect to whether or not you will permit two research projects operating at the same time to develop the same end item in different services?

Mr. QUARLES. We do have a policy which says that we will only permit such things to take place in duplication in 2 services under the circumstances where the competitive advantage of having 2 people try to do the same thing warrants it, or the importance warrants proceeding along 2 different tacks to be sure we get a successful answer out of one; or in general under those circumstances where such duplication would, in our judgment, be prudent and wise to allow.

Mr. COTTER. Do you find an abuse in that field?

Mr. QUARLES. There is abuse in the sense that the competitive instincts of the departments tend to be pushing their own projects, and in a way this is wholesome, because this is an aggressive spirit of taking care of themselves; but it would be an abuse in a national sense if it were not curbed.

Mr. COTTER. Has this integrating body effected substantial economies in curbing that type of thing?

Mr. QUARLES. It is doing so and it has done so by its operations. It is fairly early in its new operations.

Mr. COTTER. Is this integrating group—the group on the left of your chart—composed primarily of military people?

Mr. QUARLES. I think you are speaking of the Coordinating Committee.

Mr. COTTER. Yes.

Mr. QUARLES. The coordinating committees are entirely military people except for membership from my office. In general the chairman of those coordinating committees is my deputy or a member from my office, and not a military person.

Mr. COTTER. With respect to these in-house organizations, within that there are a host of project orders set up, are there not? In other words, you fund for certain projects and you assign them to a certain house within a service. Is there any abuse by the departments in earmarking funds? Has any problem of that kind arisen since your administration of this field, whereby in a sense Congress loses control of money by having it committed to these projects and then having the projects amended beyond the 3-year period and so forth, carrying over a substantial reserve of funds with some elasticity, which are used on this project and that project and so forth?

Mr. QUARLES. I feel that there is not an abuse of the authority Congress has vested in the Department of Defense, in the military departments, to use these funds.

Mr. COTTER. Congress loses control somewhat, does it not, if the funds are earmarked and not used for a project but are continued year after year?

Mr. QUARLES. Congress has allowed some flexibility in the shifting of funds from a project to another project within certain limitations and within certain percentage limitations. We, of course, observe those legal limitations on the funds.

Mr. COTTER. But from where you sit you do not see any abuse in that practice?

Mr. QUARLES. Not an abuse of the congressional authority; nor do I think that it is other than wise and proper that the whole system be flexible enough so that you can, as the situation changes, in some measure adapt yourself to it.

I do not see any general abuse. I do not say that there has never been an abuse, but it is not, in my judgment, a general abuse.

Mr. RIEHLMAN. I would agree with you, Mr. Secretary, that there certainly must be some flexibility, because this program is constantly changing. You might start out on one thing, and you would have funds earmarked for it, and if you were tied to that and found it was not going to be a successful development you would want to switch over.

Mr. QUARLES. Exactly.

Mr. RIEHLMAN. I do think the counsel has a point in the fact that unless we felt pretty well assured that these funds were properly handled in the transfer and that there was good reason for them to be transferred from one project to another and that there was not a careless manipulation we would not want to do it. That is the point we are looking at, I think, and that is what the counsel has in mind; because if you had people who wanted to divert these funds from one project to another and hang onto them even though they did not need them, that could be carried on to quite a degree and we would, as Members of Congress or the Congress itself, lose control over those funds eventually, if they were not properly watched and guarded.

Mr. QUARLES. Let me say that there are some pretty good watchdogs in this situation.

In the first place, it is the whole purpose of my office and setup to make sure that the funds are used wisely, however they are used. In other words, if a project should be dropped out and we have the latitude to apply the funds on a new project it still requires the coordination and concurrence of my office that the funds should be used on the new project.

Moreover, it requires the Comptroller of the Department of Defense to account for it and make sure that what is done is within the latitude allowed by the Congress for the use of funds.

I think there are very proper restraints both on the technical side and on the accounting side to avoid the kinds of abuses counsel is speaking of.

Mr. RIEHLMAN. Do you have any other questions?

Mr. COTTER. I have one more.

Mr. Secretary, what is your general, overall policy with respect to when production contracts should be awarded with respect to the development of a new end item? Is there any tendency to go into production before you have a finished tested product? Is there any policy with respect to that?

Mr. QUARLES. There is a tendency to do so because particularly under war pressure there is a tendency to keep pressing, as we would say in golf, to get things faster than the system is really designed for. So there certainly is such a tendency.

Mr. COTTER. Has your shop done anything to counteract that?

Mr. QUARLES. Two things have been done.

The Assistant Secretary of Defense for Applications Engineering has been established very largely for that explicit purpose of monitoring this transition from research and development to production to see that, No. 1, you do not get ahead of yourself and try to produce before you are ready to, and, No. 2, you do not try to produce more different kinds of things than you should. In general it is to assure good management in the transition from research and development to production.

Mr. COTTER. Is there some standard rule that normally contracts should not be let until you do have a product that has been developed and given some practical test?

Mr. QUARLES. The standard rule is that the product should not only have been developed but field tested and proved to be a satisfactory product before it is put into production. But I must say that rule has been breached on many occasions by pressure to get things soon.

It is the function of my office and of the Assistant Secretary of Defense for Applications Engineering to ride herd on this thing and to keep these pressures in balance.

Mr. COTTER. Does the O. K. have to go through your office?

Mr. QUARLES. The O. K. does not have to go through my office for the initiation of production. The comptroller has to approve funds for such purposes, so that the Department of Defense has a curb on it.

The Assistant Secretary for Applications Engineering must, in certain areas, such as guided missiles, be advised of plans for production, but he does not approve them.

Mr. COTTER. He does not approve it, either?

Mr. QUARLES. No.

Mr. COTTER. You have no absolute control on it?

Mr. QUARLES. I would say in an absolute sense that we do not. The funds are appropriated to the Secretaries of the Departments. It is their responsibility to control them.

Mr. COTTER. I think that is all.

Mr. RIEHLMAN. Mr. Jackson, do you have any questions?

Mr. JACKSON. I have no questions, Mr. Chairman.

Mr. RIEHLMAN. Are there any other questions from members present?

Mr. MORRIS. I have one question.

Mr. RIEHLMAN. All right, Mr. Morris.

Mr. MORRIS. In response to Mr. McCormack's question of some time ago you were speaking about leaving the research and development functions in the technical services of the Army, such as Army Ordnance, Army Quartermaster, and so forth; leaving the research and development functions at that level, along with the procurement functions at that level; and that the liaison between the procurement functions and the research and development functions was helping. I wonder if you would care to comment on the difference between that system of leaving the research and development at that level and the system that obtains in the Air Force, where you have the separate Air Materiel Command for Procurement and Supply Management in Ohio and your Research and Development Command in Maryland.

Mr. QUARLES. Yes; I would be glad to comment on that.

The Air Force system does bring the Research and Development Command up to a higher level than in either of the other two military departments, but even in the Air Force system there is a close tie, for example, between the Wright Field Research and Development Center and the Wright Field Procurement Center. So these people are brought together in practical liaison, practical relationships, at the Wright Field level. But the command is taken higher in that case.

Mr. MORRIS. Do you feel that the Air Force organizational setup works better than the Army, or could you not say?

Mr. QUARLES. Commenting on it as an organization detached from people I do not believe that I have a feeling that one is better than the other. I think people vary. At any one time you might say one works better than the other. The situations that are confronted by the two organizations are quite different. The Army covers a lot of area that the Air Force does not try to cover. For example, the Army's Corps of Engineers has a function that you do not find in the Air Force. The Army has work in chemical warfare, in the Chemical Corps, which is another kind of thing. There are a lot more technical services in the Army than there are in the Air Force, so that the situation is not really entirely comparable.

Mr. MORRIS. Yes, sir.

Mr. RIEHLMAN. Are there any other questions?

Mr. MORRIS. Just one other question.

Mr. RIEHLMAN. Yes, sir.

Mr. MORRIS. In response to Mr. Lantaff and Mr. Ikard in their questions along this line you were speaking about Reorganization Plan No. 6 of 1953, in connection also with Department of Defense regulations, having given you the power to work with the Assistant

Secretaries of Defense, the Joint Chiefs of Staff, your coordinating committees in your office, and the Deputy Chiefs of Staff in the various services, to monitor research and development programs; and you distinguished between two types of situations. One is where a single service is developing a weapon which is peculiar to that service alone, such as the atomic cannon; and then you have the other situation where one or more—possibly all three—services were developing similar weapons, such as possibly in the field of guided missiles.

I was wondering as to the first situation, where one service is developing a weapon peculiar to itself, whether your office has some responsibility in connection with that. Is there any example there of where you have disapproved a project which one service wanted to develop?

Secondly, in the other situation, I was just wondering if you would like to comment on the extent of the differences in the guided-missiles program and resolutions that might have been made by your office in the roles and missions of the various services in the guided-missiles field.

Mr. QUARLES. There have been instances, in the first category of single service, where the service proposals have not been approved and have been dropped. Ordinarily that kind of coordination takes place on an informal basis, so that things are not formally proposed for approval and then disapproved. These ideas are worked out in a less formal way than that in advance.

In the area where 2 or 3 services are interested in the same kind of project, usually the arguments are tougher in such cases, but there are instances—and instances on guided missiles in particular—where the service proposals have not been approved and where programs have in fact been carried forward which were not the ones originally sought by the individual services on their own responsibility.

Mr. MORRIS. On that particular guided missiles program, Mr. Secretary, since the subcommittee was interested in that—and I do not believe you spoke to the subcommittee about that particular program—could you state now what areas are left unresolved as to the roles and missions of the various services and what areas have been pretty much resolved?

Mr. QUARLES. I am told by the Joint Chiefs of Staff that they consider that the roles and missions of the services have been adequately resolved by the Key West agreement as modified last fall. So our present view is that there is no roles and missions problem that is unsolved and therefore causing confusion in the guided missiles field.

Now, there was a question between the Air Force and the Army, as you probably know, as to just what areas they should cover in the ground-to-air guided missiles; that is, the ground defense field.

We are now proceeding on the basis that the Army is responsible for this kind of defense to the extent that it is local defense as distinguished from, say, continental defense, where you try to draw up a line around the boundary of the continent to defend the whole continent.

Local defense of strategic areas is the Army mission, and we are proceeding on that basis.

Mr. MORRIS. That is all, Mr. Chairman.

Mr. RIEHLMAN. Any other questions?

Mr. BREWER. Mr. Chairman, I would like to ask one question.

Mr. RIEHLMAN. Yes, sir.

Mr. BREWER. Do you know all the chief scientists at all the research and development centers, or do you ever come in contact with many of them?

Mr. QUARLES. I cannot say that I know them all. I have visited a lot—I think all—of the most important of these research and development centers, and I know a lot of the people; but I do not think I know them all.

Mr. BREWER. Is there any interaction between your office and these individuals in the normal course of business; or is it unusual if one should initiate contact with your office or if you should initiate contact with a chief scientist?

Mr. QUARLES. Well, I would say it is unusual except in the informal sense that I have friends who are chief scientists at some of these places. I certainly have normal relationships with them directly, but they would not regard it as a normal thing to come directly to my office with one of their problems which is a departmental problem.

Now, on the other hand, I have had some that get feeling a bit excited about their situations, who just come to my office anyway. When they do come I talk to them, but that is not a normal procedure.

Mr. LIPSCOMB. Mr. Chairman, along that same line do the scientists who work in the Military Establishment have to go through the chain of command, like the Army personnel go through the commanding officer and on up before they have permission to bring their complaints to you, for instance?

Mr. QUARLES. I would say the literal answer to that is "No." I believe any scientist who asks his immediate military commanders if it would be agreeable to them for him to come to me would receive the answer, "Yes." I just cannot imagine their saying otherwise.

Mr. RIEHLMAN. Is your question: Would he have to ask permission of his commanding officer?

Mr. QUARLES. I do not think he would have to, but I think it would be regarded as just the ordinary courteous relationship for him to tell his commanding officer that he had something he wanted to discuss with me.

This would not be an issue, is the only point I am making, but I am thinking it would be normal for him to say, "Well, I would like to stop in Washington and talk about such and such a thing." Nobody would challenge that.

Mr. LIPSCOMB. If there is friction at a particular post you are the only place they can go to appeal; is that right?

Mr. QUARLES. Well, I would not say that, because there is the whole establishment of that military department which is still in the field. For example, if it is in the Navy there is an Assistant Secretary of the Navy who is supposed to straighten these matters out himself before they get to me. I hope he straightens out most of them, because I cannot handle more than a certain number.

I do not regard myself as his only recourse, but I think everyone would say that my office is sort of a court of last resort in matters of that kind in the Military Establishment. That is putting it a bit legalistically.

Mr. RIEHLMAN. Thank you very much, Mr. Secretary. We appreciate your very frank and courteous manner in answering the questions propounded to you this morning and the forthright way you have handled yourself here today.

The committee will stand adjourned until 2 o'clock this afternoon, at which time we will have witnesses appearing from the Navy.

Mr. QUARLES. Mr. Chairman, I appreciate very much the courteous and friendly treatment of the committee and the very constructive attitudes they have shown throughout the interview.

Mr. RIEHLMAN. Thank you very much, Mr. Secretary.

(Thereupon, at 1:25 p. m., Tuesday, June 8, 1954, a recess was taken until 2 p. m. of the same day.)

AFTERNOON SESSION

Mr. RIEHLMAN. The subcommittee will please come to order.

We have before us the Honorable James H. Smith, Jr., Assistant Secretary of the Navy, who is accompanied by Adm. Frederick Furth. It is my understanding that you have a prepared statement that you want to present to the committee.

STATEMENT OF HON. JAMES H. SMITH, JR., ASSISTANT SECRETARY OF THE NAVY FOR AIR; ACCOMPANIED BY ADM. FREDERICK FURTH

Mr. SMITH. Yes.

Mr. RIEHLMAN. You may proceed, Mr. Smith.

Mr. SMITH. I have a prepared statement, but before commencing it, I would like to say that I speak here today as the representative of a team composed of many civilians and military, who willingly and enthusiastically share the burdens and responsibilities for our research and development program and who are entitled to credit for such successes as are achieved.

I mention this team particularly at this moment because even if we were to prove to this committee that we have achieved theoretical perfection of organization charts, administrative machinery, lines of authority, and so forth, I would still admit that we should have those moments when we seem to be faced with irreconcilable differences and impassable routes. These, I am glad to say, are overcome by another factor—a very important factor, and that is the devotion of the individual members of this team to the single purpose of improving our defense capabilities.

Mr. RIEHLMAN. Would you elaborate a bit on this team that you have spoken to us about?

Mr. SMITH. What I want to emphasize there is the fact that we have civilians and military working extremely closely together as a team. We do not differentiate between the military and the civilians too much. We feel as a team the whole thing is moving ahead with each member playing his individual part on that team.

Mr. RIEHLMAN. In other words, you are trying to say to the committee there is no particular military influence or direction; is that correct?

Mr. SMITH. It is a coordinated team.

Mr. RIEHLMAN. Coordination between the civilians and the military, and there is not the usual military discipline and orders carried out in the program?

Mr. SMITH. I will go into the detail of how that team is developed in the course of this prepared statement.

Mr. RIEHLMAN. Very well.

Mr. SMITH. I have been requested to present briefly a review of the research and development work of the Navy in order that you may understand its overall scope and purpose, and know how the Navy is organized to accomplish its research and development work in an effective manner. Since our research and development effort is made up of a number of separate elements, I should like to explain that these elements are all actually subdivisions of a total overall Navy research and development program which must be planned and closely integrated to meet the urgent needs of the Navy Department.

It is necessary, first, to examine our organization if you are to understand the reasons behind our research and development program planning. Within the framework of the Navy's organization are established clear-cut lines of authority and responsibility for the several phases of our broad research and development effort. The fleet operational component of the Naval Establishment, i. e., the Chief of Naval Operations, is responsible for the establishment of the operational (functional) requirements of the fleet as the basis for preparing the technical research and development program, and for evaluation of the end products resulting therefrom, to determine compliance with established requirements. The material bureaus and the Office of Naval Research have direct line responsibility to the Assistant Secretary of the Navy (Air) for the planning and conduct of research and development work necessary to fulfill the established requirements, while the Chief of Naval Research, in a staff capacity to me, coordinates the overall technical research and development effort. Our organization, which divides the Navy's work on a functional basis, is actually very similar to that used by several large industrial corporations. Each material bureau, which might well be compared to a manufacturing subdivision of a corporation, is responsible for all phases of the material under its cognizance, including research and development, design and engineering, procurement, installation, and maintenance. In its organization for research and development, the Navy also follows industrial practice in that it has one subdivision, the Office of Naval Research, which is responsible for providing supporting research to meet the common needs of the Chief of Naval Operations and all the bureaus, including fundamental research in areas of peculiar interest to the Navy which is so necessary for continued progress in engineering and warfare fields.

Advantages of such an arrangement are that it provides detailed control of each part of the total effort by technically and scientifically competent personnel skilled in a particular area of responsibility such as naval aircraft, ships, or ordnance, supported by field activities to meet the needs of that type of equipment. This means that one group of personnel can be familiar with and responsible for an end item such as an airplane or a component such as a powerplant and follow it closely through its research and development phase, its operational evaluation and modification where necessary, and its procurement, including the plant facilities therefor. Comments and criticisms on

the value of equipments to the fleet are also received and acted on by the same groups. Overhaul and maintenance problems are included in the general task. Thus the Navy's organization provides a continuity of material responsibility for all phases of an equipment or weapon from its inception to final retirement, by one organizational entity.

In reviewing the Navy's overall research and development effort, it is necessary to emphasize our important operational responsibilities and capabilities since the research and development work exists solely to satisfy the fighting and operational requirements of the Navy and Marine Corps.

The work of the Navy logically breaks down into four major tasks although it will be apparent that such tasks are overlapping and supplemental to each other and frequently supplemental to the work of the other departments in our total Department of Defense capabilities. These four tasks are:

First, the security of overseas transport;

Second, naval striking power;

Third, amphibious operations; and

Fourth, defense of the North American Continent from attack through the sea approaches.

This order is not one of relative priority or importance but is simply a major breakdown of the operational tasks to be carried out.

SECURITY OF OVERSEAS TRANSPORT

The overall problem of establishing and carrying out an effective transportation overseas of the men, materials, and weapons required in military operations and of maintaining an orderly flow back to the Unired States of the urgently needed materials is a very serious task and one which has, as you will remember, placed the outcome of both World War I and World War II in jeopardy until the serious situations existing at the time were overcome. The magnitude of this problem can probably best be understood by realizing that approximately three-fourths of the earth's surface is covered by the oceans, and by visualizing the men, materials, and equipment the United States must transport overseas by sea routes to maintain sustained operations in a foreign theater, as well as the quantities of materials we must bring in if we are to continue to build the tools of war. It is disturbing to note that in spite of the great effort made through research and development to provide substitute materials, actually the magnitude and seriousness of this list of required import is constantly growing as indicated by the report of the President's Materials Policy Commission which was submitted in June 1952. This situation is due primarily to the natural growth of our civilian economy and would be greatly aggravated by conditions of war.

Assuming there are available to the United States the necessary cargo ships, transports, and tankers to do the job, these ships can only be effectively operated if they have adequate harbor facilities available, and, more important, if they can in wartime safely move over the ocean areas of the world. In coping with this problem our ships at sea, whether alone or in convoys, must be prepared to meet three major threats: the enemy submarine, enemy mines, and enemy aircraft.

(*a*) In order to protect our ships from attack by enemy submarines in the open sea, we are carrying out a vigorous antisubmarine warfare program. This work includes the research and development on the necessary equipment for antisubmarine use.

It includes the development of a number of aircraft and aircraft components for the highly specialized antisubmarine mission. Another major antisubmarine effort is devoted to research and development work on submarine detection and tracking techniques and equipment. Outstanding progress has been made in all of this work, but much remains to be done. There is also a major effort on the development of antisubmarine warfare weapons which include rocket-thrown weapons and acoustic homing torpedoes. It should be pointed out that this whole problem of antisubmarine warfare, including the underwater and airborne detection systems, are peculiarly Navy problems, and, since there is no industrial counterpart, the only work going on in any of them, in spite of their great and vital importance, is that being supported by the Navy.

(*b*) In order to protect our surface ships from enemy-laid mines, we must develop better methods of mine detection, mine location, and neutralization or destruction. The mine problem is a particularly difficult one because of its nature and the method of employment of mines. A complicating factor in the mine problem is that much of the work may have to be carried out in the approaches to foreign harbors where knowledge of the sea enviromental conditions may not be generally available in the early stages of a war. A vigorous mine countermeasure program is accordingly being carried out. In considering the mine countermeasure problem it should be emphasized that the whole field of harbor defense is a Navy responsibility, and it is pointed out again that these problems are peculiar to the Navy and receive no research and development assistance either from industry or from the other military departments.

(*c*) The need for protection of transports and convoys against enemy air attack has long been recognized as an important task. To meet the threat of attack by a sporadic long-range airplane or to destroy an enemy airplane which may simply be shadowing a convoy in order to guide the attacking forces in, the Navy is actively developing several promising types of aircraft. Particularly valuable shipping and convoys would also undoubtedly have protection from carrier based aircraft. Such aircraft may also frequently be required for protection of our shipping as it is subjected to increasingly vigorous attacks when approaching overseas ports.

In summarizing the importance of our research and development effort in maintaining a maximum degree of security to our overseas shipping, it is pointed out that an efficient program in this area of national defense will have a profound effect on our national economy, not only because it guarantees the continuing availability of the necessary materials for our production programs, but also because of the savings made in our shipping needs, if the great shipping losses that have been sustained in past wars can be prevented.

NAVAL STRIKING POWER

The second capability we are supporting is our great mobile striking power. Its heart is the carrier task force and includes work on both

improved naval aircraft and equipment for the aircraft itself. One of the most important problems here is the collection and intelligent assimilation of all the information being received in a carrier combat information center, such as from search aircraft, picket submarines, ships' radar, and underwater sound equipment, and the effective dissemination of this information in a form which can be used promptly by responsible commanders. Work is also going forward on the materiel required for carrier operations, particularly in developing more powerful and improved airplane launching and landing equipment. Recent experiments with new operating principles such as the canted deck arrangement have been most encouraging. Our success in this field is indicated by the fact that high-performance land-based jet aircraft of comparable performance are operating effectively from carrier flight decks where simultaneous landings and takeoffs are now feasible.

The remarkable performance of the carrier-based aircraft now under development gives the carrier task force its great offensive power. As a typical example, in the heavy attack class we have an airplane which is now flying and which is capable of carrying the Navy's largest bombs on long-range missions 600–700 miles per hour. This airplane with a combat ceiling of over 40,000 feet has truly exceptional capabilities.

The weapons which our carrier aircraft deliver and carry cover all the important types; namely, the newest types of weapons, bombs, air-launched missiles, and aircraft guns. Appropriate research and development on these weapons and their fire-control systems is vigorously underway.

A great feature of the carrier task force is its ability to stay at sea and keep fighting, which is made possible by the fast tankers and supply ships. In order to accomplish this, there is a continuing development of new transfer methods, which is permitting our replenishment at sea to reach a high state of efficiency. In the overall operation, helicopters are proving a great value for personnel and supply transportation and for plane guard and rescue purposes, and their active development continues.

Thus, in addition to its mobility and availability throughout the world, the carrier task force provides the country with a great sustained seaborne offensive capability.

An important, but more independent type of offensive capability, is the submarine itself. This involves development of navigation, communications, search, and attack equipments, but the biggest effort is in new propulsive methods including that of nuclear propulsion.

Our air and submarine laid mining potential is also an important offensive capability against enemy shipping and submarines. New types of mines, and their components are being worked on to meet this need.

In connection with the threat of enemy submarines and aircraft to our overseas shipping which was discussed previously, naval striking power will assist greatly through:

(*a*) Attacking submarine bases and airfields.

(*b*) Destroying enemy submarines en route from their home ports by submarine and air laid mines.

(*c*) Seeking out and destroying enemy submarines by our own attack submarines.

AMPHIBIOUS OPERATIONS

The third important responsibility is that of conducting amphibious operations. It is important because it is a principal means of operations by which the surface, subsurface and air potentials of the fleet may be employed to establish and maintain a foothold in almost any area in the world.

While amphibious operations were developed to a high degree in the last war, and were used effectively in Korea, the threat of the employment of mass-destruction weapons against the forces engaged in this type of operation has demanded that great emphasis be placed upon research and development effort directed toward better ships, aircraft, vehicles, weapons, and equipment, as well as new techniques for their employment.

The vulnerability of an amphibious task force to the effects of an A-bomb can be lessened or nullified by a dispersion of the forces involved in the operation. The basic military requirement to concentrate a preponderance of force at the right time and place remains as axiomatic to success as ever; research and development effort seeks, however, to resolve the apparent conflict between the defensive requirements for dispersion and the offensive requirement for concentration of force at the critical time and place. Tactically the solution lies in surprise and speed.

Present development efforts in helicopter design will, if successful, overcome the present restrictions on load capacity and radius of action. Helicopter limitations as well as other requirements still make necessary a waterborne assault by the bulk of the landing forces. Great increases in the speed of landing craft must be attained in order to concentrate troops from widely dispersed ships on to the beach in a matter of minutes rather than hours. Studies and designs of new hull configurations and propulsion systems are being directed toward an optimum landing craft. Considerable effort is also being directed toward improving the amphibious vehicles which do not stop at the water's edge, but can land troops inland in deployed formations.

Since troops in aircraft, boats, and vehicles are restricted in the use of their organic weapons, the essential fire support must come from the ships and aircraft present. Great efforts in other fields to improve naval gunfire, rockets, missiles, and mines are of especial interest here. Complicating factors in this type operation demand a great degree of coordination and control of this supporting firepower. Communications being the tool for the exercise of these command functions, current projects seek to simplify and make certain that timely and effective close and distant fire support is always available to the landing troops.

The magnitude and complexity of these operations, coupled with the vital increased tempo of activity, impose tremendous logistic problems on the commanders concerned. To assist in overcoming these difficulties of greater amounts and faster handling of supplies and equipment, studies and projects on all phases from packaging and improved cargo-handling equipment, to "mobile breakwaters" and new ship design are being conducted.

DEFENSE AGAINST ATTACK THROUGH THE SEA APPROACHES

The fourth important operational responsibility is the protection of the North American Continent from attack through the sea approaches. This responsibility becomes increasingly important as the Russian capability to wage atomic warfare increases. Solution of this problem will require close collaboration with other departments, particularly the Air Force, and is emphasized here simply to bring out those phases of the continental defense problem peculiar to the ocean areas.

Consideration of this problem shows that we must be prepared to defend the United States from three types of threat:

The first threat involves attack by long-range aircraft carrying atomic weapons; the second threat comes from the guided missiles launched from submarines and surface ships; the third involves mines laid by submarines, tramp steamers, or hostile merchantmen.

To cope with the first threat—that of attack from long-range aircraft—close coordination with the Air Force is necessary, and this is occurring. The Navy has long had an active program aimed at the development of effective equipment and procedures for fleet air defense, and much of this equipment is proving of great value both to the Air Force and the Navy in the development of an adequate air defense system. Aircraft and shipborne radar equipments are being developed for fleet air defense to provide solutions for the early warning problem. It now appears that it may be practicable to devise a defense system for the sea approaches which not only will provide early warning against enemy aircraft, but also provide airborne assistance in the detection of enemy submarines. This problem of early warning of approaching enemy forces or sneak craft requires rapid and accurate communications and considerable effort is being concentrated on the development of such systems.

The task of keeping the Navy in a proper state of readiness to carry out these great operating responsibilities, both from a short- and long-range point of view, requires a strong, well planned and carefully coordinated research and development program to make available the many types of aircraft, weapons, operating equipments and their components that will be needed. The research and development work of the large material bureaus provides the major portion of these items. It is equally necessary, however, to have a number of backup research and development programs of work in other vital areas of naval operations. These include: personnel research, which is concerned primarily with methods of selecting recruits for various naval tasks and providing the necessary training techniques and equipments to make them useful naval personnel; health and medical research which comprises continued efforts to improve our manpower effectiveness by maintaining high health standards and the best possible environmental conditions; supply work, which includes the development of clothing for exposed service aboard ship; work on food as it relates to storage and preparation at sea; and the critical problems of cargo handling and storage in reducing the turnaround time in port. Research and development on improved advanced base construction in developing means of constructing supporting facilities for amphibious operations are also carried out.

As will be evident from the above outline, the overall operating and warfare problems of the Navy are so diverse and so difficult that it is essential to have a broad navywide research effort to acquire the necessary scientific and technological know-how for successful accomplishment. This support is provided by the Office of Naval Research by conducting research to meet Navy needs in scientific, engineering, and broad warfare areas, by coordination within the Navy and with the other military departments, and by providing a number of services on a navywide basis, including Navy participation in all joint defense research projects being carried out among the services.

Mr. BALWAN. You mentioned support as provided by the Office of Naval Research in conducting research to meet Navy needs. You mean just support and not coordination necessarily from that level, or do you speak to this point later on?

Mr. SMITH. We will come to the coordination here in a few minutes.

Mr. BALWAN. This is just supporting research to other research in the bureau; that is what you are talking about here?

Mr. SMITH. At this moment. We will get into the coordination by the Office of Naval Research in a few minutes.

The Navy's research and development program is carried out by contract in industrial plants, in privately owned laboratories, and in universities. It is also carried out through the Navy's own laboratories or other Government facilities where appropriate. For test and evaluation the Navy uses its own facilities such as the Naval Missile Test Center, at Point Mugu, for missiles, and the Engineering Experiment Station, at Annapolis, for ship's equipment, and uses the facilities of the other services where desirable and appropriate.

In addition, the research and development projects and weapons systems as they advance into the hardware stage are subjected to continual evaluation and review; first, through the use of scientific analysis procedures by the Operations Evaluating Group, and second, through test evaluation under service operating conditions using the service personnel of the Operational Development Force.

Mr. BALWAN. Are these explained later on?

Mr. SMITH. I think we go into more detail on them.

In order to insure proper management of our research and development facilities, maximum use is made of the management surveys made under the direction of the Navy Inspector General which are augmented by qualified persons from civil life who visit and constructively criticize the operation of our facilities.

As an important objective of many of our research and development projects, there is the most desirable goal of obtaining real and substantial economy. It is not generally realized that from the point of view of maximum results per dollar, the funds spent on research and development may well be the most important and effective in an appropriation since any reduction in cost accomplished through development of a smaller, cheaper, longer lasting, or more efficient article, is saved many times over in quantity production. Our first and most important goal must always be to provide our forces with equipment giving them combat superiority; however, there are many opportunities where combat effectiveness and economy can both be attained. This dual objective is the goal of many of our projects.

The Navy also makes constant use of advisory groups in confirming the validity of its programs and insuring that its efforts are being exerted in the right direction. The most important of these is the Naval Research Advisory Committee created by an act of Congress, Public Law 588, and consisting of 15 of the Nation's most outstanding civilian scientists, engineers, and executives, which reviews our overall programs on a continuing basis.

One of the most important features of the Navy's research and development effort is its management and coordination. Since the one overriding objective of all the work is to provide our fighting forces with the weapons and operating equipments required for all types of naval operations, it is essential that the Chief of Naval Operations have direct control of these programs in determining both the operational requirements and the relative emphasis to be placed on different areas of naval interest. This is accomplished by having continuing appraisal and review of the research and development operational requirements and priorities by officers responsible to the Chief of Naval Operations for our capability in various warfare areas. This procedure is formulated through the work of the Navy Operational Requirements and Priorities Review Board. Its Chairman is the Assistant Chief of Naval Operations for Readiness.

In addition, the process of review and evaluation of the research and development program goes on constantly, to insure that the technical content, scope, and funding are such as to support properly the operational requirements and priorities. This procedure is formalized through the work of the Navy Research and Development Committee, of which I am the Chairman and whose membership consists of the Deputy Chief of Naval Operations (Operations and Readiness); Deputy Chief of Naval Operations (Air); Assistant Chief of Staff, G–4, United States Marine Corps; Chief of Naval Research; and the assistant chiefs for research and development of the bureaus.

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Mr. BALWAN. Can you tell us how long this last-named Committee has been functioning?

Mr. SMITH. This Committee which I have just referred to is the result of the reorganization which was initiated several months ago under the chairmanship of the Under Secretary of the Navy, and which was approved by the Secretary of Defense, I would say probably 6 weeks ago, and the Committee itself has now had 2 meetings.

Mr. BALWAN. This is a reorganization plan of the Navy?

Mr. SMITH. This is a part of that overall reorganization plan.

Mr. BALWAN. This is a part of the reorganization plan which could be implemented administratively, which you have done?

Mr. SMITH. That is correct.

Mr. BALWAN. There will be other parts to this that will require legislation?

Mr. SMITH. I believe so. I believe that legislation has been presented.

Mr. BALWAN. This is a very recent Committee which has been set up to coordinate research and development.

Mr. MCCORMACK. What voice has the Assistant Chief of Research and Development on this Committee?

Mr. SMITH. We are going to present a chart here in a few minutes, I think, which will show all of this graphically, and possibly we can answer your questions at that time.

Mr. MCCORMACK. By analyzing this, the Deputy Chief of Naval Operations is not a scientist, is he?

Mr. SMITH. No, sir.

Mr. MCCORMACK. May I assume that the Deputy Chief of Naval Operations for Air, and the Assistant Chief of Staff for the Marine Corps are not scientists?

Mr. SMITH. When we say that they are not scientists, they are all naval officers. They may have degrees, so they are not disqualified professionally.

Mr. MCCORMACK. I would not want you to draw such an inference. That is the farthest thought in my mind. I just wanted to get the information as to how, in case of a disagreement between the officers and the Assistant Chiefs for Research and Development of the bureaus, just how potent would be the opinion of the Assistant Chief of Research and Development. Do they sit in there coequal with the others?

Mr. SMITH. They are equal members of this Navy Research and Development Committee.

Mr. BALWAN. This is a military Committee for the most part?

Mr. SMITH. A military committee which advises me in my capacity as Assistant Secretary of Navy for Air. I have had also, as I mentioned before, a civilian committee which is known as the Naval Research Advisory Committee, which is composed of the 15 scientists that I mentioned a few minutes ago, and that committee was set up by law, which also advises me.

Mr. BALWAN. Those are advisers in a consulting capacity?

Mr. SMITH. That is correct.

Mr. BALWAN. They are not full-time employees of the Navy?

Mr. SMITH. No.

Mr. BALWAN. You have no committee composed of your civilian chief scientists which will advise you, to supplement the information which comes up through your military line of command?

Mr. SMITH. I can reach out and get the advice of the senior scientists in any one of these activities. We have a chief civilian scientist in the Office of Naval Research, Dr. Piore, and to him I look for advice frequently.

Mr. BALWAN. He is a highly recognized scientist, I understand.

Mr. SMITH. Yes.

As a further step in the management and coordination process I wish to stress the important technical coordination carried out by the Navy on a day-to-day basis through the constant and intimate association of the people from the bureaus, laboratories, and Chief of Naval Operations responsible for any particular field of endeavor. This type of interchange of detailed information occurs in all scientific and engineering fields on a continuing basis. In some particularly difficult fields, such as underwater acoustics, underwater ballistics, rocket propellants, aircraft instruments, mine countermeasures and electronic countermeasures, there are formal Navy groups who meet at frequent and specified intervals to exchange technical information and report mutual progress.

Where appropriate, similar participation in work in the other departments is carried out. Concentration within the Navy through

the participation in all joint defense projects by one organization, the Office of Naval Research, also provides a most effective coordinating medium since all work channeling from the bureaus to these projects and work emanating from the projects themselves back to the Navy is brought together for continuing review and evaluation by one responsible entity in the Navy Department. Our work in supporting the broad warfare objectives of the Chief of Naval Operations in such important areas as antisubmarine warfare, mine warfare, and amphibious warfare also provides excellent technical coordination on a Navy-wide basis.

Mr. McCormack. What is the complexion of the Office of Naval Research?

Mr. Smith. I would like to refer that to the Chief of Naval Research, Admiral Furth.

Admiral Furth. Would you like for me to tell you about my office operation now?

The office was created by an act of Congress for the purpose of augmenting and coordinating the research in the Department of the Navy, and to take care of all Navy's patent and copyright matters. We are a service organization providing information to all of the Navy for their use in the design and development of new weapons and weapon systems. We are not a developer of a prototype for production. We get basic information, or do some experimental developmental work, but we do not do the type of developmental work of hardware for actual use.

Mr. Ikard. Do you do any basic research?

Admiral Furth. Very much of it. We do practically all of the basic research that is done by the Navy.

Mr. Ikard. How is your shop made up between the military and the civilian?

Admiral Furth. I am prepared to take that up. I can do it now with the charts if you would like to see them, or following the statement. I think possibly it might be better after Mr. Smith completes his statement.

Mrs. Church. You may proceed.

Mr. Smith. I wish again to stress, that although the Navy's research and development work is necessarily carried on among the several bureaus, the Marine Corps, and the Office of Naval Research in keeping with the organizational structure of the Navy, actually each of these is merely a part of a total overall program, closely planned integrated and carried out to meet the overall needs of naval operations.

Mrs. Church. It has been suggested that this is an appropriate place to break the testimony of the Assistant Secretary, so any member desiring to ask questions, to ask questions up to this point may do so. Perhaps you wish to go through with the rest of the statement in which I believe Mr. Smith gives specific answers to the questions that have been sent.

Mr. Smith. We have some information on our past expenditures and future appropriations, and we go directly into the answering of the questions.

Mrs. Church. Is it the wish of the committee to proceed to the end of the report rather than interrupt for questions?

Mr. IKARD. I think that it would be best for the Secretary to proceed.

Mr. SMITH. Costs of research and development program:

The costs of the Navy's research and development work for fiscal years 1953, 1954, and 1955 are shown in the following table. It should be noted that amounts indicated for fiscal year 1953 are firm figures, those for 1954 are estimates, and those for 1955 are the planned amounts.

	Fiscal year 1953	Fiscal year 1954	Fiscal year 1955
Direct costs	$443,331,000	$399,011,000	$389,271,000
Indirect costs	$44,023,000	$45,375,000	$45,892,000
Percent of indirect to direct	9.9	11.4	11.8

Mrs. CHURCH. How do you estimate ahead? Do you carry a potential cost for the whole program, or do you have a convertibility clause whereby you can get extra money when needed?

Mr. SMITH. I would like for Admiral Furth to answer that.

Admiral FURTH. That is the entire appropriation as requested in the President's budget. It is a continuing appropriation. It brings together now all of the research and development funding of each of the Bureaus into a single package called research and development, Navy.

Mrs. CHURCH. Does not include carryover appropriations?

Admiral FURTH. This does not include carryover appropriations. The request for carryover appropriations is covered by our appeal and reclama to the Senate Appropriations Committee, where we have asked for the carryover of unobligated balances of the past year.

Mrs. CHURCH. Admiral, how can you estimate for research and development what you will need?

Admiral FURTH. In terms of dollars?

Mrs. CHURCH. Yes.

Admiral FURTH. Well, we know what the costs are for the operation of our existing facilities. We have those costs from past records. Likewise, in making up a program of projects, to support the operational requirements of the Chief of Naval Operations, we can make quite close estimates of what the cost will be in terms of manpower, and in the supporting indirect costs in terms of materials which will be needed. It is true that they are estimates, but they are the best estimates we can obtain, not only from our past records but also by discussing the problems with people who eventually might be associated with the work itself—it is mainly drawing upon experience.

Mrs. CHURCH. Who has the final authority for making the definite use of funds? Are most of your funds obligated at the beginning of the year in anticipation, or is there a considerable cushion there that can be used if needed?

Admiral FURTH. I am afraid that I do not understand the last part of the question.

Mrs. CHURCH. What I am trying to determine is not really the amount of money involved, but the chain of authority down.

Admiral FURTH. Each project is reviewed from the bureau level, coordinated, reviewed by Mr. Smith's committee, forwarded to our

comptroller, reviewed by the comptroller, and also the projects themselves, the technical projects supporting the program, are reviewed by Mr. Quarles' office in the Department of Defense. We must have Mr. Quarles' approval on those projects before we are authorized to make a formal submittal of our budget estimate for research and development to our comptroller. The program again is reviewed by the Secretary, the budget is reviewed at the Navy level, and then by the Secretary of Defense on through the Bureau of the Budget and to the Congress.

Now, coming back again, after an appropriation bill has been signed, and before we are given any obligational authority in research and development projects, the approved list of projects must come back to us from the Department of Defense. From that point on then the apportionments are made to the various bureau offices concerned with the conduct of research. They then have the authority on the the approved projects to commence their negotiations for obligating the funds.

Mrs. CHURCH. Have you felt that you have had sufficient authorization each year?

Admiral FURTH. That is a very difficult question to answer, Mrs. Church. We would all like to have more. We feel we could do more. It is reasonable. We feel that we have a very worthwhile appropriation and we certainly try to get the most research we can from each of the dollars appropriated.

Mr. MCCORMACK. Do you know how far advanced the potential enemy is in connection with new discoveries in the field of research?

Admiral FURTH. I am afraid not. We have information which is evaluated as to its authenticity. We try to get as much information as we can, but I do not believe anyone could ever say he is sure of what the other fellow has. We are not sure. We know that the other people are putting great emphasis, much more so perhaps then we, on this area, particularly in the field of training new scientists and engineers, and we know that we have to be on our toes and keep going all the time, and we may find ourselves at a technological disadvantage.

Mr. MCCORMACK. I think that is a very fair answer. You have knowledge of some of the things they are doing through intelligence and otherwise?

Admiral FURTH. We have some certain knowledge, yes.

Mr. MCCORMACK. I assume what should be done is being done.

Now, following out Mrs. Church's inquiry, do you think that we are making sufficient effort in the field of research? That is an embarrassing question to you, I know. I will not press it.

Admiral FURTH. It is a difficult question to answer categorically. It is really difficult. It is not embarrassing.

Mr. MCCORMACK. I will withdraw the word "embarrassing." If that is a question you may not prefer to answer now, you may use your own discretion.

Admiral FURTH. I think I would give again the same answer that I gave Mrs. Church; namely, we could actually build up a program which would be severalfold what our appropriation is. Then, to evaluate that program in terms of manpower and facilities available, you would probably arrive at a figure which would be larger than what our appropriation is. You could devise a tremendous program of what you would like to do but you are limited, not entirely by the dollars,

but by the knowledge and the technology available to the scientists, and the number of scientists and engineers and the facilities in which to conduct this work. We could use more money, yes, but how much I could not tell you offhand.

Mr. McCormack. Of course, basic research is the very essence of all research, is it not? Your applied research and developmental work and engineering work follow that?

Admiral Furth. That is right

Mr. McCormack. They are all important, but unless you have those fellows doing the basic research that come up with the things we might think strange, we might find ourselves in a bad position. They do that in their thinking, and they are very valuable persons.

Admiral Furth. Yes.

Mr. McCormack. You cannot underestimate them?

Admiral Furth. No.

Mr. McCormack. You cannot underestimate them at any time, particularly in the world of today and tomorrow. Of course, in the field of basic research there is bound to be a lot of justifiable expense that does not produce results.

Admiral Furth. Yes.

Mr. McCormack. But if you do not know those things, there is something that might develop that might be of vital importance to our country.

Admiral Furth. We say, sometimes, that negative results from basic research are almost as valuable to us as positive results.

Mr. McCormack. So, in that field there has to be a certain freedom of thought and decision in the expenditure of money, and one does not realize there is not always success.

Many projects should be explored, ideas, theories, anything you want to call them, in the minds of individuals or groups of individuals in the field of basic research; is that correct?

Admiral Furth. That is correct.

Mr. McCormack. Do you have money enough to give you freedom of action? You have money enough to give them freedom of action to go ahead on basic research, do you?

Admiral Furth. Well——

Mr. McCormack. I mean to reasonably go ahead.

Admiral Furth. Yes; reasonably, yes. That is the function primarily of the Office of Naval Research. We are the people who do the most of the basic research for the Navy. We do the exploratory work, the kind of work that the development group, such as a material bureau, would not be justified in spending their money on.

Mr. McCormack. Do you give the scientists in your field the authority to go ahead?

Admiral Furth. Yes. I ought to explain to you how this works.

Actually, we do not conceive the projects that are conducted in basic research. We operate with all of the universities, the nonprofit laboratories, the commercial laboratories; and our own supporting laboratories. They conceive of the projects. They submit the projects to us. We evaluate the projects and if they first look reasonable—if it looks like the work should be done, that the particular type of work that they propose to do fits the Navy's mission, is not on the other side of our dividing line between military basic research and the basic research supported by the National Science Foundation—

and we have the funds available, we make the funds available to the individual, or the college, or the university.

Mr. McCormack. Or the people in your own service?

Admiral Furth. Or the people in our own service. The scientific people then conduct the research; they do the work. We do nothing about it. We administer only insofar as the fiscal aspects are concerned. We do not tell them how to do their work. They do the work and they will tell us the results. We analyze the results. If the results are not promising, if it looks like we are going up a blind alley, we stop. If the results are promising and they look good to us, then we refinance as the funds are expended year by year, until we draw to the end of a project. These projects, the type that you are talking about, are dreamed up by the real research scientists, and they are allowed to do the work as they plan.

Mr. McCormack. Suppose that there is a difference of opinion between the research scientist and your associates on the workability; who makes the final decision?

Admiral Furth. The final decision whether to continue the work or abandon the work?

Mr. McCormack. Yes.

Admiral Furth. That has seldom occurred. I have never been faced with a situation like that.

Mr. McCormack. That answers the question.

Admiral Furth. The scientists are among the first to recognize when they are going up a blind alley. They recognize it themselves. Together we arrive at a consensus. We agree that the work should go on to such and such a point and then stop.

Mr. McCormack. Who would make the final decision?

Admiral Furth. That final decision would be left up to my deputy and chief scientist, Dr. Piore.

Mr. McCormack. And he is a civilian?

Admiral Furth. He is a civilian.

Mrs. Church. You may proceed, Mr. Smith.

Mr. Smith. I would like to go back to this question of money just a second. In addition to the funds which are made available to us through our appropriations, we are now stressing to industry the need for their putting more private funds into research. We do not expect them to put those funds into research and development of things that are solely of use to the Navy, but where there is some possible commercial application, or commercial market, we are trying to convince industry to go ahead with research projects of its own, and in that way we are augmenting the amount of money available to our general research, although in those cases we do not have the control.

Admiral Furth. Many projects are partially financed through our appropriated funds and partially financed by universities and nonprofit laboratories and industry. We make a great deal of use of that. We feel we get more for our money when we have the other people also participating in the funding of a project.

Mrs. Church. Do the foundations come into this picture at all in their appropriations to universities?

Mr. Smith. Yes; they do.

Mrs. Church. Do you make the request for the foundation, or the university for the project?

Mr. SMITH. No. They make the approach to us. They approach us with the projects they would like to work on and which they feel will be of great value to the Navy.

Mrs. CHURCH. In other words, it is a two-way street; you make some suggestion.

Admiral FURTH. We make some suggestions.

Mrs. CHURCH. And the university makes some?

Admiral FURTH. And the university makes some; yes.

Mrs. CHURCH. The university makes a contract and asks you for help, financial help, for the university?

Admiral FURTH. We do not make any grants. That is one place where we differ in our operations from the National Science Foundation. We have no grants. Our work is all straight contract work for specific projects, based upon the individual workers. We make the contract with the university solely—we select the university, solely because of its capability of project leadership; simply because it is outstanding in its field, and we have no grants.

Mrs. CHURCH. Now, if the university comes to you with a project and asks for your approval, then you make a direct grant in that case, do you?

Admiral FURTH. No grant; we make a contract.

Mrs. CHURCH. You make a contract, I mean.

Admiral FURTH. Yes; we make a contract.

Mrs. CHURCH. To cover the full cost of the work?

Admiral FURTH. It may cover—it may be financial, it may be that it will finance the project for a period of 12 months, or 24 months. Usually we like to have, on a long-range research project, to have it financed for as long as 12 months in advance. In some cases, where funds are very tight, we can only finance it for the year; but we make a basic contract.

Mrs. CHURCH. I wonder if you or Mr. Smith could write into the record a brief analysis of what is meant by direct costs and indirect costs?

Mr. MCCORMACK. May I inquire, with your permission, Madam Chairman——

Mrs. CHURCH. Yes, sir; Mr. McCormack.

Mr. MCCORMACK. Admiral, does the Army, Navy, and Air Force operate their military-research program separately?

Admiral FURTH. Yes, sir.

Mr. MCCORMACK. And in different ways, do they, according to the needs of the service?

Admiral FURTH. Yes; and they differ somewhat, although the Air Force operates in a manner quite similar to the Office of Naval Research; that is, in their research program.

The Office of Naval Research was the first organization of its kind created in the Military Establishment. It was established at the end of World War II, primarily for the purpose of giving continuity to the work that was being conducted by the Office of Scientific Research and Development under Dr. Vannevar Bush and to carry on the Navy's interest in that type of work.

The Air Force was created subsequent to the establishment of the Office of Naval Research and they, in turn, have used the pattern of the Office of Naval Research for their Office of Scientific Research.

Likewise the Office of Ordnance Research in the Army has used the same pattern. Moreover, their chief scientist was obtained from our organization. He went directly from the post of science director in the Office of Naval Research to the Office of Ordnance Research as its first chief scientist. As a result, the same general methods are used by both organizations.

Mr. McCormack. What is the relationship between the military personnel in the Navy and the civilian scientist? Is there any irritation?

Admiral Furth. No. Their scientists are a part of my office——

Mr. McCormack. Take the officers: What are their experiences and training in connection with the field of science?

Admiral Furth. The officers who are associated with the actual technical program are college graduates; most of them hold master of science degrees, and in a few cases we have officers who have Ph. D.'s in science.

Mr. McCormack. What is the policy of rotation practice?

Admiral Furth. Within the research establishment, the general policy—I can only speak broadly here—is for the officers who are technically trained, to have a tour of duty from 2 to 3 or 4 years. I can cite my own case: I was director of the Naval Research Laboratory for 3 years and a half, which was the normal tour of duty.

Mr. McCormack. What is your opinion—confining this to the Navy, because I will not ask about the other branches because it would not be fair to ask you to comment on the other branches—but what would be your viewpoint, if you care to express it, or if you feel you can and care to, about officers who are important to this particular field, the new field, and of course, we are really in a field of recent origin, so far as the intensity is concerned, so we have got to appreciate that fact and to realize that it is going to be a growing field in the years that lie ahead, and what would be your viewpoint about officers in the Navy being given the opportunity to make that a career, like they do in some of the other services, such as engineers and the Judge Advocate General's Office?

Admiral Furth. I can speak as an individual only in this case. I would be very sorry, personally, to see such an organization and policy. First of all, I believe it is essential to realize that the individual may be outstanding in science, but to be outstanding in science, he must start in science, and stay in science, and be a scientist all his life. The individual may have scientific technical training and background and early in his life move into the administration field, and if he concentrates on administration, he may become very excellent and capable as an administrator, but he loses immediate contact with science, and I think there are very few cases where this is possible—where the individual has maintained his scientific level concurrently with his very competent administrative level.

So you have your choice early, and either follow the one pattern or the other. Both are needed. You cannot run a research establishment without proper administration, and in that administration, the administrator certainly must be sympathetic with the scientists who work in the organization. The administrator must understand what the scientists' problems are, and what they are talking about, and give them every possible assistance, so that they are allowed

freedom of thought, and are able to go ahead with the work of the office.

So I feel that it would be a mistake if we just trained naval officers and then tried to make scientists out of them.

Mr. McCormack. Well, I was not directing myself solely to administration, although I think it is vitally important to have real administration.

Admiral Furth. Yes.

Mr. McCormack. With the understanding, and the experience, and the ability to appreciate the fact of maintaining the background of the civilian mind, and also the military, and weld it into as good a team as it is possible to do. Of course, you are always going to have some gripes, but I am just talking about doing the best job that is humanly possible to do.

Admiral Furth. Yes.

Mr. McCormack. There are very few in the field of science, men of a great deal of administrative experience and ability.

Admiral Furth. We have a large number of officers who are very capable administrators, who have been associated in engineering and science.

An important aspect of the career of the naval engineering duty officer is that he not lose contact with the operating forces and their beeds, because he is the individual who can translate the functional needs, of the fleet, expressed by a nontechnical officer, into technical language that the scientist can understand and put to work.

Therefore, again, I would hate to see the narrower pattern of research and development prevail; our officers should get out into the field operations and be able to bring operational needs back into the scientific area, so that the scientists can understand better the problems of what should be done to provide the solution.

Mr. McCormack. And I would say in that case, that he is not only getting new ideas, but he is being broadened.

Admiral Furth. Yes.

Mr. McCormack. What about complete separation? Suppose the man, say, has a rotation of 3 or 4 years. We had evidence this morning in the Army of from 1 to 3 years. A man might go up and be the head of a laboratory, and the man means all right, and he is doing the best he can and doing a good job, but he is shot out to be the commander of a regiment of infantry——

Admiral Furth. We have a little different organization in the Navy. We have in the Navy what is known as engineering duty officers, and aeronautical engineering duty officers. I happen to be an engineering duty officer. I do not go to sea; I do not command ships. I am qualified to command an industrial and research activity ashore. My life has been devoted to engineering and to science. I am rotated; I have been rotated throughout the Navy. As I said, I had a cruise of 3½ years as Director of the Naval Research Laboratory. I was transferred from there to the Bureau of Ships and was the Assistant Chief of the Bureau of Ships for Electronics where I dealt with matters concerning research in the electronics field plus the additional problem of production installation and maintenance of electronics.

From there I was ordered to the position which I now hold. We stay quite closely in our technical area. It is not all research and development, but it is in the area of research and development, really

industrial engineering activities. We specialize in that. So there is continuity in that sense.

Mr. McCormack. And it has a broadening experience, I can see that. But in other words, suppose that situation did not exist, where a man was relocated and went on for 2 or 3 years, and then he came from the infantry and was put in charge of laboratories, and then he was transferred to a branch of the service separate and distinct from what he had been doing; then what would be your viewpoint, as it applies to the Navy?

Admiral Furth. If it applies to the Navy, then all I could say would be this, that you would have to be very, very careful in selecting the individual, because, despite any organization or organizational pattern, personality plays a very important part in the smooth operation and function of an activity of the type we are talking about, such as a laboratory. I think you would have to be very careful, very careful, in selecting a man who comes off of a ship, say, when moving to a command on shore, to be sure that he is the type of individual who understands the problems and the people associated with the type of work that is being done in the shore establishment.

Mr. McCormack. The more probability—the natural result would be to keep the man within that particular sphere of activity, which is important to, and all related to, one another.

Admiral Furth. Of course that happens to be, as has been expressed, the Navy's thinking on the question of research.

Mr. McCormack. Of course, you understand that we are not making any investigation. We are all interested in the United States of America, and our national interest is to get the maximum results.

Admiral Furth. Yes.

Mr. McCormack. And that is the whole objective, because the sum total, either good or bad, affects the national interests of our country, and we are all concerned in getting the maximum results.

I think you have given me some very valuable information, so far as the Navy is concerned.

Mrs. Church. Is that all, Mr. McCormack?

Mr. McCormack. Yes.

Mrs. Church. Will you proceed, Mr. Smith?

Mr. Smith. A further breakdown of distribution of costs for fiscal year 1953, the last year for which firm figures are available, is shown in the following table. This analysis indicates the spread of funds among the various types of activities engaged in the Navy's research and development program.

In naval activity, $120,864,000.

Mr. Ikard. May I interrupt you, Mr. Smith, to ask if you would mind—not in detail at all, but just generally speaking—telling us what you consider naval activity, and the other Government activities, as you go through them?

Admiral Furth. The naval field activity includes the evaluation, research, and development laboratories.

Mr. Ikard. That is in general?

Admiral Furth. Yes.

Mr. Smith. Other Government activity, $17,328,000, which is 3.9 percent of the total.

Mr. Ikard. What generally is that?

Admiral FURTH. That would be the National Bureau of Standards, the NACA, and includes other Government facilities and installations.

Mr. BALWAN. For the record, what is meant by NACA?

Mr. SMITH. The National Advisory Committee on Aeronautics established by Congress.

In universities, we spent $46,168,000, or 10.4 percent.

Mr. IKARD. Just what is that? I know the answer, but I would like to have in the record.

Admiral FURTH. Universities and nonprofit laboratories studies.

Mr. IKARD. Work on projects?

Admiral FURTH. Work principally, basic and applied research projects; occasionally very few experimental developmental type of projects.

Mr. SMITH. In private industry, we spent $258,971,000 or 58.4 percent of the total. The total direct cost was $443,331,000 for the fiscal year 1953.

Mr. IKARD. Private industry, the figure given there, just what, in general, does that cover, Admiral Furth?

Admiral FURTH. That covers primarily applied research and development, and the development of the item which ultimately will, or would, go into the structure.

Mr. IKARD. In other words, the breakdown here of the figures would, and I am speaking generally now, cover the basic projects?

Admiral FURTH. That is correct.

Mr. IKARD. And private industry would cover the application?

Admiral FURTH. The application of the technical development of the actual piece of equipment for production. This would include the pilot models.

Mr. IKARD. The prototypes.

Admiral FURTH. The types that have been approved by the fleet would go into production.

Mrs. CHURCH. Before we go on to the next part, I would like to ask a rather irrelevant question, but I do not want to go by this point. In the four parts of the Navy, where would you bring in the work of the 7th Fleet?

Admiral FURTH. There are——

Mrs. CHURCH. Am I not right, Admiral, that it is for the defense of Formosa?

Admiral FURTH. I really cannot answer that question, because I do not know the answer, not being part of the Chief of Naval Operations.

Mr. SMITH. The 7th Fleet I would consider as being in the second category.

Mr. IKARD. The striking force?

Admiral FURTH. The striking force.

Mr. SMITH. The potential striking force.

Now, we will return to the problems and issues which were presented to us by the committee.

The problems that are posed in enclosure (1) to the chairman's letter of June 1, 1954, to the Secretary of the Navy are very searching and go to the heart of the matter in regard to research and development operations in the military department. The answers require a great deal of thought. The Navy has been concerned with these problems as their solutions bear directly on our efforts to improve the

entire research and development operation. From time to time, questions related to the problems raised in enclosure (1) have been considered by the Naval Research Advisory Committee. We are planning to submit these queries to this committee at its next meeting so that we may have the benefit of the thinking of this distinguished civilian group that is so familiar with the problems associated with the conduct of research in the military departments.

Mr. BALWAN. May I interrupt to ask if you would give us the names of the people who are on the Naval Research Advisory Committee?

Mr. SMITH. I will be glad to give you a complete list.

Mr. BALWAN. May we have that for the record?

Mr. SMITH. The names and their association with private industry.

Mr. IKARD. And could we have a little of their background for the information of the record?

Mr. SMITH. Yes, we can give you that very quickly, probably tomorrow.

And I might add here that we sincerely appreciate the interest of this committee, and the fact that you have raised these questions, and we look forward to hearing your views of our replies to those questions.

In answering the question posed specifically, it is first necessary to make some general observations. The entire research and development effort in the Navy Department is designed to insure superior weapons and weapons systems to the operating components of the Navy. To accomplish this, a variety of laboratories, test stations, and related experimental activities and installations are needed. These installations do not have similar research and development missions; therefore, they differ organizationally. The Operational Development Force, which is part of the Atlantic Fleet, is, in a sense, a research and development activity since it is that part of the fleet that makes the final operational and functional evaluation of experimental equipment prior to the authorization by the Chief of Naval Operations for production and introduction of such equipment in quantity into the fleet. Obviously, the Operational Development Force is a completely military organization, with occasional civilians in residence to aid in the design of tests that will be valid in terms of future developments in the laboratory. In the other extreme, there is in Orlando, Fla., the Underwater Sound Reference Laboratory, which is completely manned by civilians, with the exception of one security officer. Between these two extremes there is a variety of organizational patterns which then reflect themselves in a different relationship between the civilian component and the military component, and the organization is tailored to meet the mission of the establishment.

As in any large organization, improvements can be made in the crisper formulation of the mission in some of these establishments and a more definite and at times an improved relationship between the military and the civilian components. This we are aware of and we attempt to deal with these problems on an individual basis in each establishment, since each activity has a special function and must be tailored to fit in the overall research and development effort. We feel this is the most effective way to cope with the problem of getting the most efficient research and development program.

Depending on the mission of a research and development establishment, the military personnel have a number of functions; some of these are:

(*a*) To familiarize the military personnel by direct contact with people at the bench with the impact of technology on naval warfare in a more direct fashion than is possible by any other mechanism;

(*b*) To familiarize the civilian personnel with the operational needs of the military so that the efforts of the civilian scientists are directed toward the solution of the most urgent military problems.

(*c*) To provide liaison between the working people in the laboratory and those who originate military requirements or needs, so that the latest in technology is reflected in military requirements and so that the military requirements are properly interpreted in terms of technology.

(*d*) To provide services of ships, planes, and other military equipment in the test and evaluation.

(*e*) To provide training for officers and men who may be using equipments for the first time in the fleet.

(*f*) To provide administrative services, such as supplies, security, budgets, etc.

The relative roles of the naval officer and the civilian scientist or engineer are determined by the activity's mission.

Now, we will turn to the specific questions which were raised.

Question No. 1: "Are there any characteristics inherent in military organization which are incompatible with the administration of an effective program of scientific research and development?"

Answer: The military departments are administering effective programs in research and development.

Mr. McCormack. And by military, you mean the Navy?

Mr. Smith. Well, we are talking primarily about the Navy, but we think that is usually true of other departments. There is nothing inherent in a military organization which prevents effective administration. The objective is the creation of a strong military-civilian team, with each element contributing the maxium in the field for which it is best qualified. The success hinges on the capabilities and qualifications of the personnel, rather than on the administrative formalism.

2. Question: "Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?"

Answer: Some of the best people in American science and engineering work on military problems. The importance and challenge of the problem determine whether the best in science and technology will work on it or not, rather than the military organization of a research and development program. It is well to observe that certain military laboratories have equal or greater competence than laboratories operated by other parts of the executive department. In all likelihood, the Federal Government has the same sort of spectrum or quality of people, and the problem associated with obtaining and retaining them, as industry has.

Mr. Balwan. When reference is made to certain military laboratories having equal or greater competence than laboratories operated

by other parts of the executive department, are you referring to the Bureau of Standards?

Mr. SMITH. To any of them. We have not had any particular laboratory in mind, but the purpose was to show that laboratories operated by other parts of the executive department are purely civilian, and do not have any higher standards than those operated by the military.

Mr. BALWAN. Thank you.

Mr. MCCORMACK. Might I interrupt you there, Mr. Secretary, to go back to the last sentence in the answer to question 1?

The success hinges on the capabilities and qualifications of the personnel, rather than on the administrative formalism.

I can understand that in general, and I think we will all agree to that, but what do you mean by administrative formalism? I think I can understand it, but I would like to have that for the record, just what is meant by administrative formalism.

Mr. SMITH. I think it expresses itself pretty clearly, and that is that it is a very formal organization; the form of organization that would necessarily give you the results that the highly qualified personnel would give as results. In other words, it has to be in balance with personnel and proper organization.

Mr. MCCORMACK. On the old theory that a bad law well administered will function pretty well, but a good law badly administered would not function at all. In the legislative field, that is the feeling about it.

Mr. SMITH. I think that is a pretty good example.

Mr. MCCORMACK. Coming back to the inquiry that I made to the admiral and his answers in regard to the rotation of officers in the Navy, do you subscribe to what the admiral said about these men in related fields, their being given different assignments, where the rotation was in related fields of science?

Mr. SMITH. I think that works quite well here, where we have not too rapid a rotation. If you drop down where the rotation gets under 3 years, it probably would be cause for trouble. I think 3 to 4 years on a job and then go out in the field——

Mr. MCCORMACK. In a related way——

Mr. SMITH. In a related field; yes.

Mr. MCCORMACK. And in a related way.

Mr. SMITH. Yes.

Mr. MCCORMACK. It is not a matter of taking a man who has been strictly an officer on a destroyer or a cruiser or a battleship and putting him into this particular field; you would not approve of that as a general proposition, would you?

Mr. SMITH. No, sir. That is a question in the handling of personnel, the extent to which we can take the individual from one field and put him in another, in a totally different field and get any results at all.

Mr. MCCORMACK. So that you would generally approve of the observations made by the admiral in response to my inquiry?

Mr. SMITH. That is correct.

Mr. MCCORMACK. That his rotation should be kept within certain atmospheres where there is relationship to one another?

Mr. SMITH. Yes.

Mr. McCormack. And particularly in this important field where there is a relationship to the field of science.

I want your views on it.

Mr. Smith. I am in complete agreement with that. I do believe that the individual has to get out, away from the laboratory and into the field, to see the application of what he has developed in the laboratory and also bring to the field the knowledge of the technology that will permit the field to come up with new requirements which they may not otherwise think of. I think a rotation from the laboratory to the field can be used to keep him very familiar——

Mr. McCormack. But in the field that has a relationship to the laboratory, and the work in the laboratory.

Mr. Smith. That is correct.

Mr. McCormack. And that same man can be pulled back and be assigned in a little higher rank, given a higher rank which is only natural to all of us, and he could be given greater responsibility in the laboratory.

Mr. Smith. Yes.

Mr. McCormack. In other words, his training is right along that line, where he will out of a certain group of officers in that particular activity, who will come in like the admiral here; is that right?

Mr. Smith. That is correct.

Mr. McCormack. That is very interesting, and I think it is very important, in my opinion; and I am glad to know the information given to the subcommittee by yourself and the admiral in that respect.

Mrs. Church. Will you continue, Mr. Smith?

Mr. Smith. There is no inherent reason why military organization must create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian personnel. It is believed that the difficulties in obtaining and retaining highly qualified scientific personnel are traceable to a large extent to civil-service classification and pay scales. Moreover, many scientists are dissatisfied with the increases and decreases in a military research and development program imposed by world conditions and Federal budgetary policies. It must also be recognized that many scientists are inclined to be intolerant of the administrative duties and procedures imposed by any large organization.

Mr. McCormack. I think it is very important—what you have just said; we had evidence this morning from another Department, and I quote, in connection with the same subject:

> When you take any group of 20,000 people, you are bound to find some persons who are dissatisfied with management, whether it be in a military or civilian organization. Studies which have been made regarding the attitude of scientists and engineers toward their employment in military laboratories have indicated that some dissatisfaction stems from the military-civilian relationship, but it is not the predominant factor. More frequently reported as the basis for dissatisfaction have been inadequate compensation, lack of opportunity for advancement professionally, military security, and Government rules and regulations.

Now, in your testimony will you explain, or do you have any recommendations to make as to how you think this should be improved?

Mr. Smith. There are 2 or 3 separate items, the first one being——

Mr. McCormack (interposing). To a large extent, civil-service classification?

Mr. SMITH. And pay scale.

Mr. MCCORMACK. It is traceable to that?

Mr. SMITH. Yes; the pay scale differentials vary, and I think we have, through a period of years on the outside, had the experience where civilian pay has been extremely high. I think it may be coming down a little bit, so that the differential may be coming a little closer, and if that is true, it will not be as important an item. I am not too sure——

Mr. IKARD. May I ask a question there?

Mr. SMITH. Yes.

Mr. IKARD. Would you suggest or recommend, or is it your feeling that it might be well for the committee to give consideration to an increase in the pay scale to certain classifications of scientists?

Mr. SMITH. I do not feel I am competent to make a recommendation of that kind. It is involved in a very much larger picture of the relationship of pay in Government service to pay in industry, and I would consider the scientists a part of a general picture.

Mr. IKARD. What would be your feeling about that, Admiral, if you want to express it, and if you do not have an opinion, well, fine; I just wondered.

Admiral FURTH. I have felt that most recent personnel legislation which groups all of the classified personnel under the general classification, was somewhat partial to the professional engineers and scientists. I would like to make clear that when I say "engineers and professional scientists" I am speaking about the type of people in whom I believe this committee is interested, the people who are doing research and development.

Mr. IKARD. Yes.

Admiral FURTH. Not the engineers who have been at the management level, who are administrators of the type of work being conducted in industry. I feel that there was some harmful effect resulting from that general classification of administrative people with these highly educated professional research workers. It put them in the same class with the other people, and they fell that they should have some preferential treatment. Now, that is strictly a personal opinion.

Mr. IKARD. You feel then, I take it, that that legislation, as far as the top people are concerned, might have resulted in some detriment to the cause of the Government in getting men in research?

Admiral FURTH. Yes; it could have had that effect. In public law, the positions in science are set aside; they stand out, they shine, because they are by themselves. The pay scales of the top brackets in the general schedule group, and in Public Law 313 are very much the same, yet the scientists stand out, apart, and are recognized as outstanding individuals.

Mr. IKARD. And many times that is an important consideration.

Admiral FURTH. That is exactly the case with the scientist—he is more interested in how he is accepted by the scientific community, in many cases, and in the opportunity to publish his papers, and to be recognized as an outstanding individual in his discreet area of science—this is often more important to a scientist than the compensation in dollars.

And this is why the military service—and I am speaking about the Navy—has been able to retain the services of a number of our outstanding people, because of the Navy's policy of allowing them to

publish in their professional journals and technical periodicals, the results of their work, if their work is not classified.

Mr. McCormack. What about the existing law? Is there any restriction in the existing law that you think has a disturbing effect?

Admiral Furth. No; I could not answer that.

Mr. McCormack. Do you have the authority, under organic law, administratively, to meet that requirement?

Admiral Furth. I know of nothing——

Mr. McCormack. In this morning's session, we were told, given testimony, that there is a lack of opportunity for advancement in the profession, and apparently the Navy Department meets that.

Admiral Furth. Yes.

Mr. McCormack. The Navy Department takes care of that, but in this same testimony that was one of the criticisms from another branch, the lack of opportunity for advancement professionally, the publication of their papers, and certain relationships with other scientists, organizations, and so forth. Also Government rules and regulations; that was testified to this morning. But you know of nothing so far that has any effect on the Navy?

Admiral Furth. I think Mr. Smith has covered all that I can think of.

There are a number of administrative rules and regulations which must be complied with. Some civil-service regulations may be very annoying to anybody involved in writing a position description sheet, but they are rules and regulations which we, who have lived with them, accept. I think I can say also that all of the scientists and engineers of my acquaintance, the ones who have been in the service for a long time, go through this procedure regularly and they come to accept it. It is usually the newcomer who is irritated, but after he has been in the service for a while, I think he accepts them. There are many procedures which are required, and I could not offer any suggestions for changes, but they are annoying to people who think in a little different terms than the person who is trained in fiscal matters would think.

Mr. Ikard. May I ask one more question?

Mrs. Church. Yes, certainly.

Mr. Ikard. Do you feel that the matter of security is, as far as speaking generally of the problem is concerned—that was one item that was mentioned this morning, and I would like to get the ideas of you gentlemen on that?

Mr. Smith. I feel sure that it is very frustrating, to develop new ideas, and not be able to publish them. But that is something that we are all faced with. I do think that it probably works a little greater hardship on the scientist than anyone else, which we can understand—who likes to see published in a document something new. We have given a great deal of thought to that, and of course, we have to stop them from doing that, and we are making every effort to follow the security rules. But it is more difficult in that regard, because many of them are classified, as far as the outside public is concerned, and they are not able to have it published.

Mr. Ikard. It is their child and they cannot brag about it.

Mr. Smith. That is generally the situation.

Mrs. Church. Any further questions?

Mr. Balwan. Yes, if I may.

You do have some difficulty in obtaining and retaining highly qualified scientists, such as you have mentioned here. In talking with Secretary Quarles this morning, he included some evidence concerning the rate of turnover, and I wonder if it might be possible, Madam Chairman, to ask for information giving us the turnover of the chief scientists, and their grades, say, from GS–14 on up, with an analysis of the reasons why they left?

Mr. SMITH. We are preparing now, and it will take a little time, some comparative data of the turnover within the military establishments and the turnover of civilians in the normal research enterprises, and I think that will give you what you want.

Mrs. CHURCH. I think that will be helpful.

Admiral FURTH. I think it will be a little difficult to give a breakdown because we are again faced with several classifications of the employees and the record that is being kept in the general service classification—you can get the GS–14 turnover, but when you try to separate professional engineers and scientists from the others, it becomes quite a difficult problem.

And because it is such a difficult problem at the present time, we are, in my office, making plans for the establishment of a section to keep just this type of information. I have been working with the Office of Industrial Relations, and the Chief of that Office, and they are trying to get information for us, and they feel that we should try to keep it.

I do not know whether we will be successful or not, but we will make a very determined effort to get the figures for you. I happen to remember some figures, comparative figures of a few years ago when our turnover, the professional turnover within the Navy was in the order of about 1 percent per month, and 15 percent overall. In industry, making a comparison with the same type of establishment, the turnover was 1 percent greater, making it 16 percent.

Mr. BALWAN. I do not know that I quite see the relevancy of making a comparison of the turnover in your case with industry. In other words, it may be that your turnover might be as high, or even lower, than the turnover in industry, but there still would be a great problem in the Navy, would there not? There would be little satisfaction in knowing that you got a turnover that was less than in industry, but yet be losing a lot of your scientists.

Admiral FURTH. Yes.

Mr. BALWAN. Despite the fact that you had a lower loss than industry.

Admiral FURTH. I think the answer to your question is this, and I would like to cite the situation which is one that I was very close to, and one that occurred in the laboratory where I was the Director.

A commercial laboratory started a new organization, and they had a number of commitments to meet and they started a sort of wholesale proselyting of outstanding scientists, all over the country, and they enticed them away by offering them higher salaries, much higher than associate members in the same association, of which they were a part, were offered in considerably higher grades.

It just happened that they took away from our laboratory two individuals who were our key people in the laboratory. Now, that hurt very seriously, the losing of those two people. They took away a total—I believe my figures are correct, although I am relying upon

my memory, but they took away, and finally employed—of 12 people from the Naval Research Laboratory.

Mr. BALWAN. Was that the Hughes Corp.

Admiral FURTH. Well, I was not going to mention names but since you asked that question, yes, it was the Hughes Corp.

Now, in taking 12 people, 10 of them made little or no difference to us, but 2 of them hurt. Those two hurt very, very badly, because they happened to be key people, but it did not upset the function of the laboratory. We have managed very well and we have managed to recruit people and we carried on and met, I feel, our responsibilities and did a very creditable job, I believe.

So it is not, as you say, the turnover in numbers that hurts; it is where somebody who is very important as part of the organization is enticed away by these higher salaries.

Mr. BALWAN. That is why I asked the second part of that question; that the absolute number, such as 12 or 15 turnover, would not be more significant, and that is why I directed my question and asked information on the question of turnover, particularly in the grade levels where they might be more significant than the total number which includes the Indians in the lower level.

May we have that information. I did not quite get the response to the question?

Mrs. CHURCH. Yes. The answer was that it might be difficult to get it.

Admiral FURTH. But we will try to get the information for you as soon as we can. We tried to get the information before this statement was prepared by we did not have sufficient time. We are trying to get the information now, and we hope it will be here by tomorrow.

Mr. BALWAN. That answers my question.

Mrs. CHURCH. Mr. Smith.

Mr. SMITH. Then the third question: "Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?"

Answer: This question cannot be answered categorically, "Yes" or "No." The British have created the Ministry of Supply. Much of the military research and development program in Britain is under that civilian organization. Other components are under the Army and Royal Navy. The experience of the British again indicates that one solution is not necessarily superior to another. I am again returning to the concept of the mission of the various components of a program. It is felt that those portions of the program that are primarily research are best administered by having civilians play a major role. Those programs are primarily development, one finds that best results are obtained with a large military participation. Test and evaluation portions of the research and development program require participation and, at times, domination by the military.

Question: "Would it be feasible to organize military research and development programs in such a way that the technical activities capable of being performed by a civilian organization could be separated from those which are purely military, such as support functions?" Where military support activities are necessary in connection with a research and development project, and such activities must be under a military commander, does it necessarily follow that the

technical research and development functions must also be under direct military supervision?

Answer: It would be feasible, but not an effective, closely knit organizational entity. Each research and development activity is tailored to meet most effectively its mission.

Question: "To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs?" To what extent should private, nonprofit institutions participate? To what extent should private industry participate? How much "in house" research is required for the military service to be capable of exercising qualitative control over research and development conducted by outside laboratories?

Answer: It is found that it is necessary to utilize industrial, university, and military laboratories in order to have a well balanced research and development program. The "in house" research in its primary mission is not to exercise qualitative control over research and development conducted by outside laboratories. It is done to provide certain skills and unique facilities that can be best accomplished in military laboratories. Similar observations can be made in regard to university and industrial laboratories. These three types of laboratory are not in competition for the same type of work and problems. They supplement each other. Each has its certain characteristics and capabilities, and all three are necessary to meet the varied and complex requirements for weapons, equipments, and the technical needs of the operating fleet with its supporting activities.

That concludes my statement.

Mrs. CHURCH. Now what would follow with reference to that?

Mr. BALWAN. We had given some comments on questions and answers on the problems that were given to him. I notice the admiral had some charts. Are you going to show the charts in connection with the next set of questions or when are you going to bring those in?

Mr. SMITH. Well, we can run through the next set of questions, and then if you want to take a look at the organization, we can bring out the charts.

Mrs. CHURCH. Do you have that with you, Admiral?

Admiral FURTH. Yes, that is a part of the plan.

Mr. SMITH. I will go along with the questions and answers with your permission.

Mrs. CHURCH. Yes.

Mr. BALWAN. Did you know you had these other questions, Mr. Smith?

Mr. SMITH. Yes; I regret to say that they must have fallen off of my voluminous documents. I am aware of them.

Mrs. CHURCH. Are you familiar with them?

Mr. SMITH. Yes, I am prepared on this.

This is the second set of questions.

Question: "Civilian scientists in military R. and D. centers are reported to be generally dissatisfied with military domination and administration."

Asnwer: To the best of my knowledge, this is not true.

Question: "Civilian scientists are leaving military R. and D. centers in a general exodus."

Answer: This is not believed to be a correct statement. An effort is being made to obtain data to compare the turnover of technical

personnel in the research and development establishments in the Department of the Navy with that of industry and other governmental research and development activities. Within the Federal service, there are additional factors of pay scale and civil-service regulations.

Mr. BALWAN. Part of that request being made for information would contribute to this question, would it not? The question concerning rotation, the number leaving in the upper grade levels, is involved?

Mr. SMITH. That is correct. The question you asked a few minutes ago will be partly answered as we are answering this question here; but your question is in a little more detail, and I believe primarily refers to the upper level in the pay scales.

The third question: "When a military organization is imposed on a research and development program there is a tendency for the military to expand its control over technical decisions and operations in the research laboratories."

Answer: Good management does not tolerate such procedures, unless there is a good and sufficient reason in each instance.

Mr. BALWAN. Where it exists now, is that taken care of?

Mr. SMITH. It actually would be very difficult for the military or the civilians to expand their control. In other words, when the organizational pattern of the particular activity is set up, the extent to which either controls is pretty well delineated.

Mr. BALWAN. We understand that in the Naval Ordnance Laboratory they operate under a charter, as I understand it, as to what are the responsibilities of the civilians and of the military people; and as I understand it, the Naval Ordnance Laboratory has an organization where they have a commanding officer who has a deputy civilian technical director. There is no executive officer as such. I think they have a military man who handles the military matters as an executive officer, and they have that relationship so that it is a predictable relationship from one year to another. Possibly if they were even to have a change in commanding officer the charter, I assume, would take care of the situation, and it would not change, assuming that the missions stay the same at the Naval Ordnance Laboratory.

Let us say we had a situation where we had no such rules. Put it this way: Is it possible to have a situation in the Navy where there are no such rules?

Mr. SMITH. I hope it is not. I think it is not. Is that not correct, Admiral Furth?

Mr. BALWAN. Do they all operate under charter?

Mr. SMITH. We would not permit the situation to develop without a fairly carefully defined charter.

Admiral FURTH. Management procedures in the Department of the Navy are such that you cannot make major organizational changes at the activity level. Everything has to stem from the chief of the parent bureau.

Mr. BALWAN. So in the Naval Air Development Center at Johnsville, Pa., we are assured of some predictability in the way the organization is going on, whoever is the commanding officer?

Admiral FURTH. Yes.

Mr. BALWAN. If we have one commanding officer, where the people feel there is a lesser degree of military control than in another

situation, you would not find a case where a commanding officer could come in and exert more military control?

Admiral FURTH. That is correct. You will not find that. I believe you will see that this is really one of the problems which follows from Mr. Smith's discussion.

I brought with me a chart of the Naval Research Laboratory, for example, with which I am familiar, because it is a part of my office. I am familiar with the Bureau of Ships Laboratories, because I was associated with the Bureau of Ships and I know they follow the same organizational pattern.

Mr. BALWAN. Do you have a charter or something which sets down the understanding between the scientist and the military people?

Admiral FURTH. Yes, indeed.

Mr. BALWAN. You do have?

Admiral FURTH. Yes.

Mr. SMITH. That is essential.

Admiral FURTH. I think perhaps it might be of value to show you how the thinking is. Perhaps you can see it from here.

Mrs. CHURCH. I think you flatter us a little bit, Admiral.

Mr. SMITH. I know he flatters me.

Admiral FURTH. I was trying to get all the committee in on this. I guess I will have to do it from the middle.

This is representative of the general type of organization. I am distinguishing between a test facility and a laboratory.

Mr. BALWAN. Excuse me, Admiral. The Office of Naval Research operates two laboratories, as I understand it. One is the Naval Research Laboratory.

Admiral FURTH. One is the Naval Research Laboratory and the other is at Orlando.

Mr. BALWAN. Do you not have a Navy Special Devices Center?

Admiral FURTH. The Special Devices Center is not a laboratory, sir.

Mr. BALWAN. It is not a laboratory?

Admiral FURTH. It is very difficult to define the Special Devices Center, because it is strictly a contract organization. It is very much like a bureau, a departmental organization, in that the work is all done outside and it is done by specifications, accomplished under contracts and specifications. At the same time it does work for the training agencies of the Navy in establishing training requirements.

Mr. BALWAN. It has a different mission?

Admiral FURTH. It has an entirely different mission. Our laboratories which we operate are two in number; the Naval Research Laboratory and the Underwater Sound Reference Laboratory at Orlando. They are the two laboratories.

The Director of NRL is a military officer. There is a block for a deputy director, but we do not use a deputy director during peacetime organization. That is a function which is reserved for mobilization, where the workload would be such that perhaps the responsibility would have to be divided.

The Administrative Department is made up of civilians and military personnel. They take care of all of the housekeeping and support functions of the laboratory and remove that responsibility from the scientific and technical personnel.

Mr. BALWAN. Who is the top man for that?

Admiral FURTH. The Director of Administration is a captain in the Navy. The administrative services officer is military. The engineering services officer is military. The Personnel Division is operated by a civilian. The Public Works Division is military, supplied by Yards and Docks. The Supply Division is military, supplied by the Bureau of Supplies and Accounts.

Technical Information is a civilian, because that is a civilian specialty. In each case you have the engineer coming from the Bureau of Ships, the public works from Yards and Docks, and supplies from the Bureau of Supplies and Accounts.

In the Office of the Comptroller, at the moment the Comptroller is a naval officer who is about to go off active duty. He is a Naval Reserve officer with wide experience in the industrial operations. He was selected because of his experience both in industrial and Federal fiscal procedures. He is about to go inactive and accept the position as a civilian.

The rest of the Department is all civilian.

The heart of the laboratory is the Research Department. That Research Department is headed by a civilian scientist. Every person in the organization, each and every one, is a civilian scientist or engineer. There are no military in there at all.

The military are part of the naval staff. They are the liaison people with the workers, the Department of the Navy; that is, the Chief of Naval Operations, the material bureaus and my office. They bring to the scientists the military and naval needs. They carry out the new technology so that we can write up problems for them.

But the heart of the organization—this whole area here—is run by civilians. The Director and the military staff are to see to it that the work that is performed within this department is directed toward the solution of military problems. They do not make the technical decisions in the sense of what the problem is to be. They do not guide the work at all. It is all done by civilians.

Mr. BALWAN. The situation we have there is not similar, then, to that which we might find in procurement, where they have a civilian and a military man sitting in the same office, with the civilian providing continuity and the military man who does the stamping and signing of letters?

Admiral FURTH. No; it does not follow that pattern.

You will find in the Administrative Department civilians who provide continuity, and in the absence of the military person the civilian can take over that job. This job could be either military or civilian.

In certain areas—for instance, in the administrative services—you need the military, because a part of that is the military program of the laboratory. This area includes all of the enlisted personnel and officers' records, and the security—plant security as well as the security of information—which all comes under administrative services as military functions.

Where the function is clearly defined as military you will find a military organization. Where it is clearly defined as civilian you will find a civilian organization.

This is the general pattern adopted by most all of our laboratories.

Mr. COTTER. Does this naval staff you refer to in any sense perform supervisory functions?

Admiral FURTH. They do not provide any supervisory functions; no. Supervisory functions are provided by the superintendents of each of these divisions under guidance of the associated superintendent of research and the top man, the Director of Research.

Mr. IKARD. And all of those people are civilians?

Admiral FURTH. Yes; this is a complete civilian organization. It is completely civilian.

Mr. BALWAN. What proportion of your total research program does the Naval Research Laboratory represent, dollarwise? For instance, your budget for 1954 is roughly $400 million. How much is spent on that?

Admiral FURTH. I would have to break out my slide rule, if I had it, to give you that figure. I do not have it, but I can tell you that this total operation from all sources is about $27 million a year. What that would be percentagewise I would have to figure out.

Mr. BALWAN. It is $27 million as against $400 million?

Admiral FURTH. Well, it is $27 million as against the $443 million; it is $27 million out of the Government part; yes.

Mr. BALWAN. Madam Chairman, the point I was trying to bring out is that we have here an example of an excellent laboratory. It is reputed to be an outstanding laboratory for a military situation. It represents $27 million out of about a $400 million organization.

There are many other laboratories in the Navy which are not Navy-controlled either by the Naval Research Laboratory or by the Office of Naval Research; is that right?

Admiral FURTH. That is correct.

Mr. BALWAN. This may not be representative.

Admiral FURTH. My own knowledge of the Navy laboratories is that this general pattern extends now to all the Bureau of Ships laboratories. I am quite familiar with that, because I went through the reorganization of the Naval Electronics Laboratory, for example, out in San Diego. The general pattern is the same.

Mr. COTTER. What is your personnel strength at this laboratory, approximately?

Admiral FURTH. 3,400.

Mr. COTTER. 3,400. How many are military personnel?

Admiral FURTH. I am drawing on my memory, and I may be off.

Mr. COTTER. Just an approximation.

Admiral FURTH. My last recollection of the total military was that it was 80.

Mr. COTTER. Does that include both officers and enlisted men?

Admiral FURTH. That includes both officers and enlisted men, and the enlisted men include the housekeeping facilities for barracks, operators of the small boats, and the hospital corpsmen, cooks and bakers.

Mr. COTTER. How many are officers of the 80?

Admiral FURTH. How many officers, total?

Mr. COTTER. Of the 80 how many are officers?

Admiral FURTH. How many are officers? I will have to give you a guess. It is about 50 percent.

Mrs. CHURCH. Admiral, there either was or was not an implication in one of the statements. I wondered when you said it was not representative of the general Navy setup whether you felt the Ad-

miral's answer to you, that this seemed to be indicative of the policy everywhere, was satisfactory to you?

Mr. BALWAN. The point I was trying to make is that I think the Admiral is explaining a very good situation, which is a very small part of the total research effort in the Navy. This would not necessarily apply to the organization in the rest of the Navy, except in those which you mention, with which you are familiar.

Admiral FURTH. I cannot speak for the rest of them, because I do not know the details of their organization, but I know they differ, if their missions differ. If they are test and evaluation facilities then this pattern does not hold. But if it is an organization such as the Naval Electronics Laboratory or the Underwater Sound Laboratory in New London, the NRL, the Naval Ordnance Laboratory at White Oak, where we do research work, you will find in general this is the type of pattern which is used.

There may be some minor modifications or minor variations, but in general this holds.

Mr. BALWAN. We would like to have that assurance. The only point I tried to show was how large a portion of the total naval research effort this was compared to the rest.

Admiral FURTH. Yes. The development effort is much larger than the research effort. That is where the bulk of the money goes; but that does not go into naval activities, you see. It is the testing and the evaluation of the production coming out of industry which comprises the bulk of our workload.

Mr. BALWAN. That answers my question.

Mrs. CHURCH. Mr. Chairman, Mr. Smith was finishing the questions and answers part of his testimony, and we are interrupting and I think getting very valuable information.

Mr. RIEHLMAN. Good.

Mr. SMITH. Shall I continue, Mr. Chairman?

Mr. RIEHLMAN. Yes, sir.

Mr. SMITH. Thank you. The fourth question: "Military research and development officers are not scientists who command the respect of the civilian scientists."

Answer: Some officers are highly respected by the scientific community; others are not. Some civilian scientists in military laboratories are highly respected in the scientific community; others are not. It is the policy of the Department of the Navy to assign qualified officers to such jobs. Officers assigned usually have had postgraduate training in civilian institutions in this country or abroad. Some have earned their doctorate degrees.

Mr. RIEHLMAN. Are there any questions on that question and answer? All right; let us go to No. 5.

Mr. SMITH. The fifth question: "The policy of rotating assignments for military officers militates against the retention of officers who in some cases have the training, talents, and disposition to guide scientific research centers."

Answer: The important feature of the rotation policy of military officers is to ensure that the research and development experience they obtain when attached to such activities is extended to other portions of the military departments. Science and technology must become part of the general planning, both operationally and budgetwise,

in the military departments. This can be assured only if naval officers acquire the experience and appreciation of science and technology and that experience and appreciation is reflected as they perform other duties. In addition, one of the best methods to inject the operation needs is to have officers with fresh operational experience participate in the work of research and development activities.

Mr. RIEHLMAN. Any questions on that?

Mr. BALWAN. We had discussed that question.

Mr. RIEHLMAN. Prior to my coming in?

Mr. BALWAN. At other times.

Mr. SMITH. Yes; we have gone into that quite thoroughly.

Mr. RIEHLMAN. All right.

Mr. SMITH. The sixth question: "Research centers often are organized and administered as military organizations with the attendant restrictive forms, procedures, regulations, and military discipline which do not provide the optimum climate for research work by civilian scientists."

Answer: This depends on the exact character and mission of a given research and development establishment. How much or how little of the military organization is needed to make this establishment operate at optimum usefulness to meet its mission in the support of the overall research and development program is the determining factor. Some of these restrictive forms, procedures, and regulations, stem from the requirements established by the executive department and by the Congress.

Mr. BALWAN. What might be these restrictive forms that you still feel are in existence that were established by the Congress?

Mr. SMITH. I think Admiral Furth can probably answer that question better than anyone else here.

Mr. RIEHLMAN. Can you answer that, Admiral?

Admiral FURTH. I am afraid I am going to have to hedge on giving a specific answer, Mr. Chairman.

What is implied here is that it is part, really, of the rules and regulations which are laid down by various agencies which we must conform to, which determine in some measure to what extent you have participation; that is, of the military and civilian participation. There are certain functions which are defined as purely civilian functions and there are other functions which are defined as purely military functions. Then the mission of the organization itself comes in, so that your overall participation is an endeavor to balance the two requirements; that is, what should be supplied by military or what should be supplied by civilians in satisfying the needs and meeting the needs of the mission. I cannot give you specific details.

Mr. RIEHLMAN. I think what Mr. Balwan was referring to was what might be stemming from the requirements established by executive orders. Certainly it would not be legislation from the Congress which was interfering with this program.

Mr. BALWAN. I think this is an important question.

Mr. RIEHLMAN. I think it is, too, because the implication is that there certainly are some restrictions by executive order or by legislation which Congress has enacted, and the sentence would lead me to believe that, at least.

Mr. SMITH. Could I raise a question?

Mr. RIEHLMAN. "Some of these restrictive forms, procedures, and regulations, stem from the requirements established by the Executive Department and by the Congress."

Mr. SMITH. I have a little different understanding of the original question that was asked us. Your committee indicated in its question that research centers are often organized and administered as military organizations with the attendant restrictive forms, procedures, regulations, and military discipline which do not provide the optimum climate for research work by civilian scientists.

Mr. RIEHLMAN. Yes, that is right.

Mr. SMITH. We all know that we have many things to do that at times seem a little unnecessary to us but are actually essential to the proper fiscal and management control of the business. I think that is what whoever asked this question originally was thinking about.

Mr. RIEHLMAN. Yes, but the answer is the thing we are concerned with.

Mr. SMITH. We in the Navy Department impose some of those restrictive forms ourselves. Other fiscal controls or budgetary controls are imposed by Congress.

Mr. RIEHLMAN. Are you referring to budgetary controls and so forth?

Mr. SMITH. I would think so.

Admiral FURTH. Yes; and civil service regulations.

Mr. RIEHLMAN. That clarifies it to some degree.

Mr. SMITH. I do not mean to indicate in this answer at all that these forms and procedures are unnecessary in the conduct of the business. They are things which lead to what is called here,

"Do not provide the optimum climate for research work."

Unfortunately we have to put in these controls and people have to follow them, whether they are scientists or in any other phase of the activity.

Mr. MCCORMACK. Mr. Secretary, we can try to provide the most optimum climate possible, can we not?

Mr. SMITH. Oh, yes; I agree with that.

Mr. MCCORMACK. What I take you to say is that the Navy has provided the most optimum climate possible under the restrictions imposed upon the Navy by the executive and the Congress. This is a pretty clear statement:

> Some of these restrictive forms, procedures, and regulations stem from the requirements stablished by the executive department and by the Congress.

That is a pretty definite statement. That would seem to indicate to me that there are some restrictions in existence. If they could be removed there would be a more optimum climate. If so, what are those restrictions? We would like to get at them. Whether we can do anything or not about them is another question.

Mr. SMITH. Some days I get the impression that the desired optimum climate for research is to have no restriction whatsoever; monetary, fiscal, budgetary, or anything else. That is a climate which neither you nor we can afford to go along with.

I am perfectly willing to accept these restrictions which I think are just those things that crop up in the normal course of doing business.

Mr. MCCORMACK. In any event, that last sentence there would have been better if it had been left out.

Mr. SMITH. No, I think that is a factual statement, but it is not intended to criticize the executive department or the Congress.

Mr. MCCORMACK. Oh, no; I do not construe you to be criticizing the Executive or the Congress. I want the record to so show. None of you gentlemen should leave here with any thought we think you are criticizing.

What we want to know is this: If there are any requirements established by the Congress or by the Executive—but particularly by the Congress—of a restrictive nature, if you could tell us what they are then we could give consideration, at least so far as the Congress is concerned, to trying to remove them. You testified to the civil service. We know that, now.

Admiral FURTH. I do not think we would recommend removal. Many of these restrictive forms and procedures are good, sound business procedures that would have to be exercised whether it was a military establishment or a commercial industrial establishment. But some of the complaints that people make against the restrictive forms are not valid, in the sense that they stem directly from a military organization.

The implication of the question was that the military imposes them. We do not. We carry out the instructions that are handed down to us from higher authority. They are given to us for good purposes, for good management. We did not mean it as a criticism, sir.

Mr. MCCORMACK. I said I do not construe it as a criticism. Furthermore, criticism is often very good, and I would construe that as such. I like to receive justifiable criticism; for I improve as a result of it.

Mr. RIEHLMAN. I think the Congressman is just as concerned as Mr. Balwan and I were when we read this sentence. The implication is that there are restrictions which have been instituted either by the executive department or by the Congress, and it specifically states it. We are not able to pinpoint it.

I suppose if you take the civil service and the budgetary program, if that is what you are referring to, that is one thing; but of course you have to have your budget and you have to recognize that certain funds are going to be made available and you have to live within them as nearly as you can. If that is what you are referring to, that is one thing; but if there is other legislation or if there are other Executive orders which are really holding up your Department, so that you are not able to work satisfactorily with those regulations and Executive orders, we should know it, and we would like to do what we can, if possible, to correct them. That is no assurance that we can.

Mr. SMITH. I do not think that we would have any hesitancy in telling you if we thought any of these things were unreasonable or bringing about an unnecessary delay in the work. I do not feel any of us believe that.

Mr. RIEHLMAN. You do not feel that that sentence would have any bearing on that?

Mr. SMITH. That is not the intention of the sentence at all.

Mr. RIEHLMAN. All right. Let us go to the next question.

Mr. SMITH. The seventh question: "The lack of either a definite or consistent policy for organizing and administering research and development centers leaves each center at the mercy of each change

in commanding officer and Executive. This creates an instability with no assurance that even the well-run research and development center will not become, with a change of officers, an unbearable situation."

Answer: This cannot occur under the present Navy management procedures. The mission, administrative policy and organizational structure of each research and development activity is established by the chief of the parent technical bureau or office.

Mr. McCormack. Well, we got a little different answer this morning on that question, and on some of the other questions, from Mr. Quarles. He said all three military departments have developed a framework of policies and procedures within which the research centers are expected to operate consistently. Detailed implementation of the policies and procedures are, however, left to the operating heads of the centers.

Of course, in the Navy you have so many civilians. I can see where you get along much better.

Admiral Furth. I do not believe that answer is inconsistent.

Mr. McCormack (reading):

In this context, each research center is vulnerable to changes in the detailed operating procedures which may be brought about by each change in its commanding officer. Here again, however, is a shortcoming that is not peculiar to the military, nor even to the Government. The many disruptions usually encountered when there is a change at the top of most civilian agencies is too well known to require elaboration.

We could discuss that, but we are discussing the field of scientists, which I think is a peculiar field.

The problem of accomplishing effective military research and development, therefore, is essentially one of achieving far-sighted and coordinated planning, programing, distribution, management, and administration of the effort within a framework of controlling policies and regulations, yet with proper regard for essential elements of the scientific method. Where the governing regulations conflict unnecessarily with the requirements of scientific progress, responsible levels of the military command must bring about the necessary changes in policies and rules. Further, all levels of responsible Government management must remain alert to possibilities for improving the administration of scientific effort leading to the development of new or improved weapons, equipment, systems, and techniques of potential military value.

Now I will say that this is a sharp difference in this respect:

In this context, each research center is vulnerable to changes in the detailed operating procedures which may be brought about by each change in its commanding officer.

I would say the Navy's operations, from your testimony, are somewhat different than those applying to some other branches of the armed services.

Mr. Smith. We covered this a little bit before you came in, I think Mr. Chairman; and our position was that the difference from that expressed in the testimony you have just read was that we endeavored to provide a continuity of the same type of control without changes resulting from changes in the individual commanding officers. That is done by directives that continue regardless of the change of personalities in the activities.

Mr. McCormack. Well, I am not asking for any comment on the testimony. That would not be fair. I just wanted to have the record show the testimony on what I considered to be an important point. The Navy in its judgment seems to have taken care of that field.

Admiral FURTH. I believe, sir, that the opening statement which you read about the organization and patterns being established holds true for our statement. They are established in the chief of the bureau or office level.

Again, I am sure that personalities always enter into it when you go into it. The organization in the Navy cannot change by the change in the commanding officer. That is something that is fixed by the chief of the bureau. He is the one who makes the changes in the organization.

As I understood the other testimony, it meant that where you change personalities you have certain operating procedures but the basic structure remains unchanged because it is fixed by higher authority.

Mr. RIEHLMAN. It is your opinion, then, Admiral, that the change of personnel would have no effect upon carrying out the directives that were set prior to your coming onto the program as a director?

Admiral FURTH. So far as the program is concerned, yes, sir. I feel it should not change the program.

Mr. MCCORMACK. And personalities would be minimized, where there is a change in commanding officer, who is simply pursuing a continuity of his general activity while in the service. I can see that, too. I am not criticizing it. I can see where I would do it myself.

Being a human being, there is no criticism involved, but it is a question of trying to improve.

Mr. BALWAN. I think the Navy probably offers examples of the best operation of laboratories. The subcommittee has looked into some of the standards where it has looked as though there has been a change of policy with commanding officers, and that is what prompted us to raise the question here. I was surprised that you categorically answered this could not happen.

Mr. SMITH. My impression from the various activities that I look at, where we may have been having a little indication of trouble coming up, is that the scope of authority that can be exercised does not change. The manner in which the new commanding officer attempts to exercise that authority may change, and that is what seems to ruffle the water for the time being, but usually that can be straightened out and there is not a continuing change in the scope of his authority at all.

Mr. BALWAN. If you have a chief scientist who has direct operational control over his laboratory, it is not possible to have another commanding officer come in and say, I do not want my laboratory responsible to a civilian; I am going to abolish that job; I will put the director down lower in the organization and have him responsible to my executive officer.

Mr. SMITH. He does not have the authority to do that. He could make that recommendation back to the parent bureau; is that not correct?

Admiral FURTH. That is correct.

Mr. SMITH. That change might eventually be made. We do change the type of organization from time to time, but the commanding officer does not in his own right have the authority to make that type of change.

Mr. BALWAN. With each change of Assistant Chief of Research and Development at the bureau level there could be a change in the structure or the organization at the lower level. Admiral Furth, coming into the picture as a new Director of the Office of Naval Research, could bring about a change at Orlando?

Admiral FURTH. That would be possible, but at the assistant chief of bureau level it would not be possible to do that. The assistant chief might have ideas of his own about how the laboratory should be organized, but he has to get the chief of the bureau's approval before any major structural changes would be made in that organization.

Mr. BALWAN. Would the chief of the bureau—say the Chief of the Bureau of Ships—have to report to the Chief of the Office of Naval Research?

Admiral FURTH. No, sir.

Mr. BALWAN. Is there any connection or coordination among the bureau research and development organizations and the Office of Naval Research?

Admiral FURTH. No.

Mr. BALWAN. They operate more or less autonomously and separately from the Office of Naval Research?

Admiral FURTH. The organization and operation; yes. The program itself is the only area where we enter into the coordination. We have a hand to play in the kind of work they are doing, but not in the management of the laboratory.

Mr. BALWAN. How direct is your control over their program?

Admiral FURTH. It is not control. We do not control, we coordinate. We coordinate by bringing together all of the people working in a specific field and developing a technical program for that field which covers the needs of the Navy. That portion of that program which best fits a given Navy laboratory would be assigned to that laboratory, and would be sponsored by that laboratory's parent bureau. In some cases the work would be sponsored by my office, if it happens to be basic research.

Mr. BALWAN. Will the development of any particular guided missiles of the Bureau of Ordnance have to be cleared through you?

Admiral FURTH. No.

Mr. BALWAN. They could initiate a research and development project on a particular guided missile project and consume information you are developing?

Admiral FURTH. They would consume information we are developing. Even if the Office of Naval Research felt that new project should not be carried out, we would have no control. I am in the position of a representative to the Assistant Secretary of Navy for Air to make recommendations to him based upon evaluations we might make. We make no decisions. We are there to provide information and service to all of the Navy, but not to make the final decisions except upon our own program.

Mr. BALWAN. Who standardizes the procedures in operating these research and development operations among the different bureaus, or is there any one place to which we can go to get some rule and regulation for operating these research and development organizations?

Mr. SMITH. I think we have made it quite clear in earlier testimony we do try to tailor the organization to the mission, and in general terms you start off in the research area, and you are predominantly

civilian, and you go along toward test and evaluation and the military comes in more and more. That is the general rule of thumb in predicting what an organization will look like.

Mr. BALWAN. The point that I am trying to make is that I do not see wherein the Navy research and development is headed up. I can see in the Air Force that we have a research and development command. It looks like each bureau chief can go along on his own. However, I do understand you do have a research and development committee composed of the military men who are the chiefs of the bureaus and the assistant chiefs in charge of research and development.

Mr. SMITH. That is right. And that committee is advisory to me because I make the decisions. I am the senior civilian in the research and development business in the Navy. I have that responsibility.

Mr. BALWAN. All that source of information is through military channels up to you.

Mr. SMITH. Not at all. The Office of Naval Research, headed by Admiral Furth, which has a large component of civilians in it, including a civilian senior scientist, Dr. Piore, consults with me directly. I have the Naval Research Advisory Committee, which was established by Congress, which reports to me, and will investigate any particular problem that I want to have them look at. Recently, within the last 4 or 5 months, we had a management problem at one of our test centers, and the NRAC, the civilian advisory committee, immediately put a subcommittee on that job to look at it on my request, and to come up with a recommendation on how we could solve either the organizational problem, or the personality problem that had sprung up there. So I can get immediately qualified civilians on these problems, as well as high military advice.

Mr. BALWAN. These are advisory groups outside of the Navy.

Mr. SMITH. They include the civilians on the permanent Navy payroll. The most senior people I have are people who are not permanently on our payrolls because they are very distinguished scientists, the presidents of corporations.

Mr. BALWAN. Dr. Piore is not on your committee?

Mr. SMITH. He is on the permanent Navy payroll attached as the civilian senior scientist and in Admiral Furth's Office of Naval Research.

Mr. RIEHLMAN. And he has direct contact with you?

Mr. SMITH. He has direct contact with me; that is right. In other words, I can have him come in and ask any questions, get his views on things, and he frequently volunteers to come in and talk about problems which he foresees.

Admiral FURTH. As I understood your question, it was not a technical control or coordination, but management. You were talking about management control, is that correct? I am trying to differentiate.

Mr. BALWAN. Both.

Admiral FURTH. Maybe I should show our chart of the relationship which would perhaps answer that question.

Mr. SMITH. We have, Mr. Chairman, about 2 or 3 more of the questions which you gave us to answer. We could answer them now and then go to the chart, which might save a little time.

Mr. RIEHLMAN. Fine. We will proceed with No. 8.

Mr. SMITH. No. 8: Question: "Several outstanding civilian scientists who have been associated with military research and development programs are reported to be in favor of changes in the governmental organization and administration of these programs."

Answer: There is always an opportunity to improve the management of the research and development program. This is a continuing problem. Recently the Department of Defense made organization changes based upon the Rockefeller Committee's recommendations Within the Department of the Navy, a committee under Mr. Gates, the Under Secretary, has recommended modifications which are now being implemented.

Mr. BALWAN. This is a very recent development in the Navy—but not too recent. I think within the past 4 or 5 months this study has come about for the reorganization of the Navy?

Mr. SMITH. The report of the committee on the reorganization of the Department of the Navy is dated April 16, 1954, and it is the result of very careful study of the overall organization with considerable emphasis on the research and development activities in the Navy.

Mr. BALWAN. What are the major changes provided in that which you refer to here? You said "recommended modifications which are now being implemented."

Mr. MCCORMACK. What did the Gates report recommend?

Mr. SMITH. I think that I can read you rather quickly the items relating to research and development.

Mr. MCCORMACK. I know that the Army had a report last year. I read that. I have it in my office.

Admiral FURTH. All three of the services were directed to do the same.

Mr. SMITH. With your permission, I will read directly from the report of the committee on organization of the Navy Department, dated April 16, 1954:

> Research and development: The committee believes that the Assistant Secretary of the Navy for Air should continue to be responsible for research and development matters, and that he should retain supervision over the Office of Naval Research headed by the Chief of Naval Research. The Chief of Naval Research is charged by statute with duties relating to the encouragement, promotion, planning, initiation, and coordination of naval research; the conduct of naval research in augmentation of, and in conjunction with research and development conducted by the respective bureaus and other agencies and offices of the Department, and with cognizance over matters relating to patents, trade-marks, copyrights, royalty payments and the like.

I am going to skip a bit here.

> The committee has noted that the coordinating authority of the Chief of Naval Research does not extend to matters of development. The committee recognizes the practical difficulty of separating applied research and development, that is, of determining the point at which applied research can be said to end and development to begin. The capabilities of the Chief of Naval Research to render fully effective staff assistance to the Assistant Secretary of the Navy for Air in the overall field of research and development would be greatly improved by extending his coordinating authority of the developmental phase of applied research and the development. The committee believes that the authority of the Chief of Naval Research should be broadened in this respect.

Now, that is one of their principal recommendations for changes, and we are implementing that.

Mr. MCCORMACK. You mean on research and development?

Mr. SMITH. To extend the coordination further into development.

Mr. McCormack. What about engineering? Do you think that ought to be included?

Admiral Furth. No, sir, not in the sense of engineering for production. That becomes an entirely different problem. That is the real breaking point between research and development.

Mr. Balwan. This has been a weakness you have been trying to correct, where the Office of Naval Research has not had any control over the research and development in the bureaus which is more developmental work?

Admiral Furth. Partially. We have had the coordination of research. We have not had the coordination of development prior to the approval of the Gates Committee report.

Mr. Balwan. How are you going to follow that recommendation?

Admiral Furth. We have a chart to show you at the end of the questioning, sir.

Mr. McCormack. Research engineering should be kept together under one responsible head rather than separated as they are now in the Department of Defense under 2 Assistant Secretaries. That is what I urged over 3 years ago. I am glad to see this as far as the Navy is concerned.

Mr. Smith. The second recommendation in the Gates report was to establish a Research and Development Committee with the Assistant Secretary of the Navy for Air as chairman, and the following members—Assistant Chief of Naval Operations, Readiness; Deputy Chief of Naval Operations, Air; Assistant Chief of Staff, G–4; United States Marine Corps, Chief of Naval Research, and the Assistant Chiefs of the Bureaus having cognizance over research and development activities.

Now, that committee was developed because of the belief of the organization committee that more effective coordination of all aspects of operation and management of the Department would result from the establishment of a group of internal advisory committees made up of key executives and designed to deal with specific categories of problems. Each committee would consider matters within its functional purview for the purpose of improving coordination between all activities of the department working in the committee's field.

These committees, of which the Research and Development Committee would be one, making appropriate recommendations with respect to problems arising in their areas would be advisory in character and possess no executive authority. Their recommendations should be furnished to the Secretary of the Navy, the Under Secretary, and the Chief of Naval Operations, and the Commandant of the Marine Corps. Those are the two basic changes that we are now in the course of implementing, and that reorganization was approved by the Secretary of Defense quite recently.

Mr. Balwan. How long ago?

Mr. Smith. I would say sometime around the 1st of May.

Mr. Balwan. May I develop this point a bit more?

Mr. Riehlman. Yes.

Mr. Balwan. I think that I have dwelt on this before. This committee is a military committee, nevertheless, and you are a captain of the officers who are studying this proposition and making recommendations to you.

Mr. SMITH do not believe that you give full consideration to another committee which was established by an act of Congress, and that is the Naval Research Advisory Committee, which is a purely civilian committee, and apparently you feel because they are only available on a temporary consultant basis, that they are outweighed by the military group.

Mr. BALWAN. No. We noted in the Air Force they do not give the research and development responsibility to an existing Secretary who has a lot of other duties, and your main duty is Assistant Secretary for Air. They have a special assistant with almost the rank of Assistant Secretary who has been purely and primarily a research and development man. I do not know your experience. I know that you have a lot of other duties besides this other committee thrown upon you to handle research and development.

Mr. SMITH. I forgot to mention another very important recommendation contained in the Gates committee report, and that is that a large part of my work is to be placed under a new Assistant Secretary of the Navy. In other words, all the personnel work which I have now, in addition to the aeronautical and research and development work, would be put under a new Assistant Secretary of the Navy, which would relieve my office of a very substantial amount of work that I have to do.

Mr. BALWAN. I did not know that.

Mr. SMITH. That, I think, is a very basic change. I thought every one was familiar with it.

Mr. RIEHLMAN. That is a recommendation. It has not been carried out as yet.

Mr. SMITH. We are seeking legislation now, and I believe it will go through quite soon. I think everyone is in favor of it.

Mr. BALWAN. In effect, you will become an Assistant Secretary for Research and Development.

Mr. RIEHLMAN. Or someone else.

Mr. SMITH. It will be that office.

Mr. RIEHLMAN. There will be a new office.

Mr. BALWAN. A new office for research and development?

Mr. SMITH. There will be the Assistant Secretary of the Navy for Air, and he will have jurisdiction over the aeronautical matter and research development, and atomic energy, which seems a reasonable package of work as compared to the original package, which also included personnel, which is an enormous piece of work in itself.

Mr. BALWAN. They have taken away personnel, but they have given you more in research and development?

Mr. SMITH. No; I have the same amount of research and development, but I have more time to do the work.

Mr. RIEHLMAN. They would take away the personnel?

Mr. SMITH. That is right. Of course, that is the area that requires the most detailed attention, the personnel side of the thing.

Mr. MCCORMACK. What is your opinion about the Assistant Secretary of Navy for Research? I have a bill in to that effect for each one of the branches. In fact, I introduced a bill for an Assistant Secretary of Defense.

Mr. SMITH. Well, the Assistant Secretary of Navy for Air would come fairly close to being that job because the title for Air is not a truly descriptive title any more inasmuch as procurement, aviation

procurement, is handled by another Assistant Secretary of Navy, so that the "for Air" title does not cover as much ground as it would appear to.

Mr. McCORMACK. When the reorganization bill was before our committee I asked some questions along that same line. I see the purpose of the inquiry of counsel. I can see the other Assistant Secretary relieving you a lot and that will give you more time to devote to your other important duties, which include research and development. Research is so important, and it is going to become more prominent and it will be more specifically identified in the years that lie ahead. I can see the importance of research and development in the world, not only of today but particularly of tomorrow.

Mr. SMITH. We certainly appreciate your emphasis on the importance of research. I am in complete agreement with you on the necessity for continuing a very high level of research.

Mr. McCORMACK. I have been very much impressed. I am thinking now of when time passes and who might be the next one in charge. If there is direct responsibility, there is an entirely different situation. However, that is purely academic now.

Mr. SMITH. Question No. 9 (reading:)

The funding of research and development is confused when handled with military budgets. Direct research and development costs are justified to and appropriated by the Congress as such. However, this does not give a true picture of the actual total cost of military research and development programs inasmuch as there are substantial indirect costs arising from military support functions in the form of pay for uniformed officers, provision of capital facilities, and certain maintenance and operation expenditures.

In this connection, it is reported that it is often felt necessary to build up a research and development center with such support functions in order to make it "respectable" in terms of size and complexity as a command for a colonel or general. This, in turn, sets off a vicious cycle in that the existence of military support elements becomes a further excuse for military domination, more officers, regulations, etc.

A. Again this depends on the mission of an establishment. If one has a research and development activity whose principal function is testing, it is more of an accounting problem than a substantive problem whether tests of new weapons should be charged to a purely military budget as training costs of the military personnel, or to the production budget as providing production aspects, or whether to research and development budget. The work is necessary and one finds that there is no uniformity even among commercial companies as to how these costs are charged.

In answer to the second paragraph of IX, it is not possible for this to occur under present Navy management controls.

I think that completes the question and answer section.

Mr. RIEHLMAN. I wonder if we could see the charts now.

Admiral FURTH. This chart [indicating] illustrates the lines of authority in the Navy, and an imaginary line drawn right through the Secretary of Navy's block divides the right-hand or left-hand portion, as you are looking at the chart in the Chief of Naval Operations and the Commandant of the Marine Corps.

The right-hand portion of the chart represents the Navy's business management under the direct supervision of the Under Secretary of the Navy with the Assistant Secretaries reporting to the Under Secretary.

We have left out a lot of the blocks to simplify this particular chart.

In the case of research and development, the requirements flow from the operating people. They are operational requirements. They are stated in very broad terms of warfare needs and urgency and are

assigned by the Office of the Chief of Naval Operations. They flow into the material bureaus, the Marine Corps, and the Office of Naval Research where we combine the projects, or we originate the projects which will support and carry out the requirements of the operating forces.

Under this new organization, the Office of Naval Research, acting in a coordinating capacity for not only the research, but also development now, acts as a staff office for the Assistant Secretary of the Navy, Air, and we combine all of the projects flowing out into the Marine Corps, the bureaus, and our own office into a single program and present that program to the Assistant Secretary and to the Research and Development Committee for review.

Now, that program is reviewed from an operational point of view by the members who have a board for them, the operational priority and review board. They review this program with respect to supporting naval operations. Concurrently, the Office of Naval Research reviews that program technically to see that the program is well balanced. By that I mean that the proper emphasis in the various discrete engineering fields is given to the overall program; that is, that there are no gaps. We are looking for gaps. We are looking for overemphasis in certain areas. We would be looking for underemphasis. We would be particularly on the lookout for any duplication of effort between the material bureaus.

In other words, by bringing these bureaus together and working and making these technical studies of the discrete areas, we expect to eliminate the gaps and have a well-balanced program technically.

Again, at the Research and Development Committee level, we marry together the operational requirements of the program as the Chief of Naval Operations sees it, as the technical bureaus see it, and come up with recommendations to the Assistant Secretary for the best type of operational support for the requirements of the Chief of Naval Operations, always keeping in mind that the Office of Naval Research must act as an agency to explore the frontiers of science. Where there are no operational requirements, we must have a lot of freedom to probe the frontiers of science in order to develop new technological problems which again flow back to the Chief of Naval Operations and to the bureaus and eventually to new operational requirements.

This is the normal order of the formation of a program. It also follows the normal order of our budgetary procedures.

Now, technical information flows back, and is shown by this blue line, to the Chief of Naval Operations. When items are developed by agencies in the management area of the Department of the Navy, they are turned over to the Chief of Naval Operations and are evaluated by his force, the operational development force, to determine that they meet the operational requirements, and they do satisfy the functional needs of the fleet, that they are capable of being maintained and operated by fleet personnel. If they are approved, the Chief of Naval Operations is then in a position to establish a requirement for those items of the nature tested for installation in his fleet, and that comes into the other part of the picture which the Secretary has mentioned in terms of procurement. We are through with the picture; we are out of the research and development after approval is forthcoming from the Chief of Naval Operations on a specific development.

Now, this is in very simplified form, to show the lines of authority. The red is coordinating up to the point of the Secretary, where decisions are made. We are advisory. We recommend but we take no direct actions.

Mr. RIEHLMAN. Are there any questions with respect to this chart?

Mr. BALWAN. This is a new organization you are talking about?

Admiral FURTH. This is the organization which has resulted from the recommendations of the Under Secretary's committee, which were approved. As soon as they were approved, Mr. Smith started the implementing action to develop this committee, and this is what has been reached in agreement with both sides of the chart—operating and management. Technical coordination on this side; policy and operational coordination on the other side of the chart.

Mr. RIEHLMAN. This has been very instructive, and is a well-worked-out program.

Mr. SMITH. I am glad to say it seems to suit everyone, so far as charts go.

Mr. RIEHLMAN. I am only talking about the chart. We want to see what the actions are when this chart and program go into action.

Mr. SMITH. I think it is safe to say we are off to a happy start. People like it.

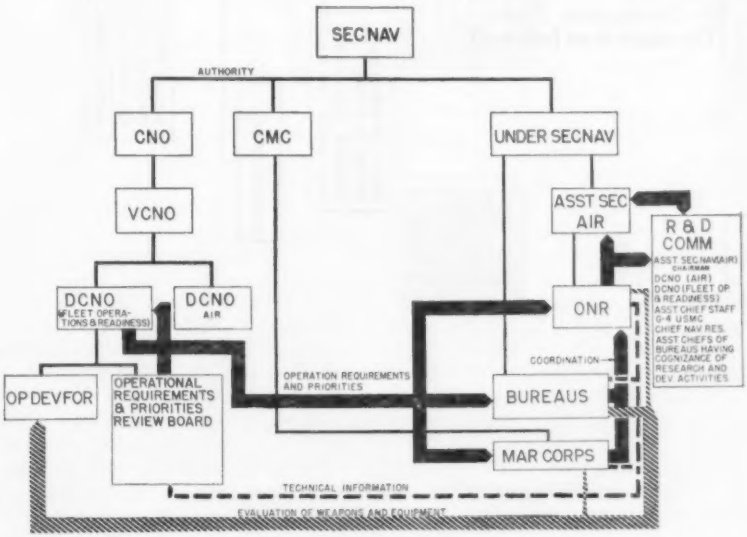
We recognize that always there will be conflicts of opinion. Everyone who has had a look at this, who is directly concerned and has some authority connected with it, is pretty well satisfied.

Mr. RIEHLMAN. Are there any questions?

Admiral FURTH. I have copies of this to leave with the committee, if you would like, sir.

Mr. RIEHLMAN. Yes. We would like to have them.

(The copy of the chart is as follows:)



Admiral FURTH. Unfortunately we did not have time to make a line drawing, which shows up well as a photograph. The colors do not show up too well, but the labeling, I think, will make it clear.

You have this technical and budgetary coordination in the red, and the film seems to be susceptible to the green and the red, and they both look awfully black. On the others you can see a slight difference in the gray scales.

Mr. JACKSON. Does the subcommittee have a copy of the Gates report, which might supplement the hearing?

Mr. RIEHLMAN. Could we have a copy of that, Mr. Secretary?

Mr. BREWER. I think we have one copy.

Mr. RIEHLMAN. We would like to have another.

Mr. SMITH. We would be glad to give you another copy.

Mr. MCCORMACK. Have we a copy also of the Army report?

Mr. BALWAN. I think the Davies report is the one we are talking about. We will have that.

Admiral FURTH. This work started, I believe, as early as last October in each of the three departments under directive of Mr. Wilson. It took a long time.

Mr. MCCORMACK. Off the record.

(Discussion off the record.)

Admiral FURTH. I have one other chart of my office, if you would care to see it, as it was before the reorganization and as now visualized, for the changes we are making to coordinate development in my office.

Mr. RIEHLMAN. I think it would be very informative, if it would not take too long. We would like to see it, Admiral.

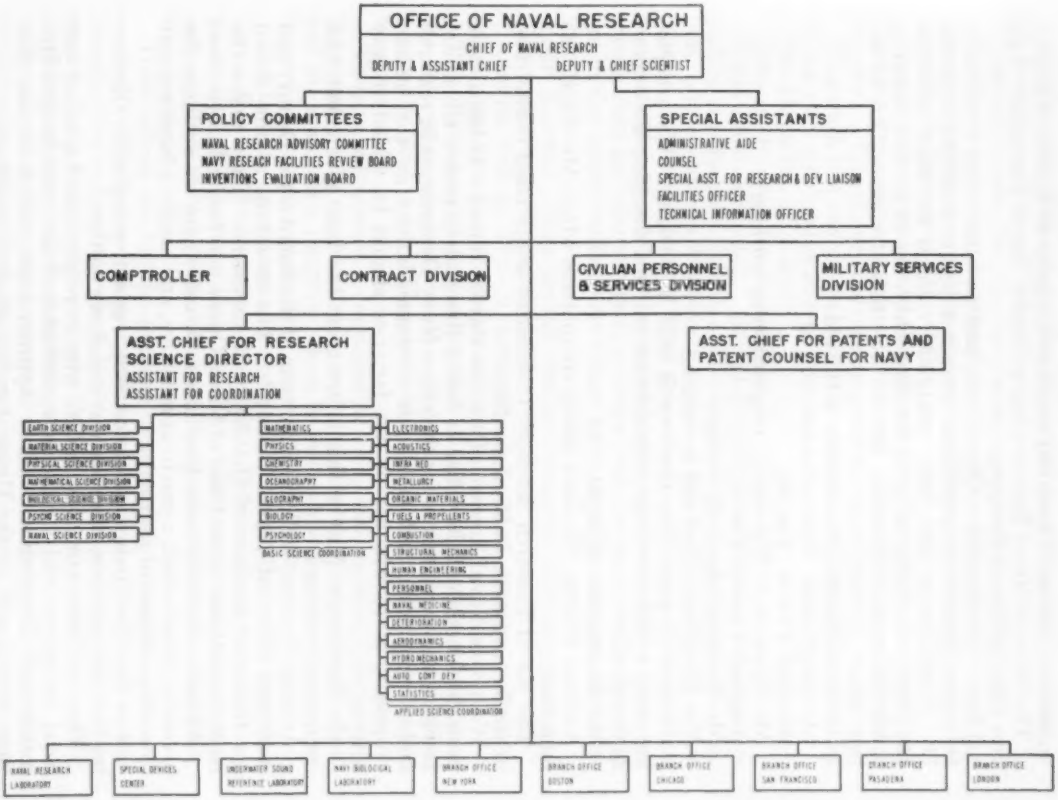
Admiral FURTH. We are not firm at all. We want to move cautiously in this area.

Mr. RIEHLMAN. Do you have copies of that which we can have for the record, too?

Admiral FURTH. Yes, sir.

Mr. RIEHLMAN. Fine.

(The chart is as follows:)


OFFICE OF NAVAL RESEARCH
CHIEF OF NAVAL RESEARCH
DEPUTY & ASSISTANT CHIEF
DEPUTY & CHIEF SCIENTIST
POLICY COMMITTEES
NAVAL RESEARCH ADVISORY COMMITTEE
NAVY RESEACH FACILITIES REVIEW BOARD
INVENTIONS EVALUATION BOARD
SPECIAL ASSISTANTS
ADMINISTRATIVE AIDE
COUNSEL
SPECIAL ASST. FOR RESEARCH & DEV LIAISON
FACILITIES OFFICER
TECHNICAL INFORMATION OFFICER
COMPTROLLER
CONTRACT DIVISION
CIVILIAN PERSONNEL & SERVICES DIVISION
MILITARY SERVICES DIVISION
ASST. CHIEF FOR RESEARCH SCIENCE DIRECTOR
ASSISTANT FOR RESEARCH
ASSISTANT FOR COORDINATION
ASST. CHIEF FOR PATENTS AND PATENT COUNSEL FOR NAVY
EARTH SCIENCE DIVISION
MATERIAL SCIENCE DIVISION
PHYSICAL SCIENCE DIVISION
MATHEMATICAL SCIENCE DIVISION
BIOLOGICAL SCIENCE DIVISION
PSYCHO SCIENCE DIVISION
NAVAL SCIENCE DIVISION
MATHEMATICS
PHYSICS
CHEMISTRY
OCEANOGRAPHY
GEOGRAPHY
BIOLOGY
PSYCHOLOGY
BASIC SCIENCE COORDINATION
ELECTRONICS
ACOUSTICS
INFRA RED
METALLURGY
ORGANIC MATERIALS
FUELS & PROPELLENTS
COMBUSTION
STRUCTURAL MECHANICS
HUMAN ENGINEERING
PERSONNEL
NAVAL MEDICINE
DETERIORATION
AERODYNAMICS
HYDRO MECHANICS
AUTO. CONT. DEV.
STATISTICS
APPLIED SCIENCE COORDINATION
NAVAL RESEARCH LABORATORY
SPECIAL DEVICES CENTER
UNDERWATER SOUND REFERENCE LABORATORY
NAVY BIOLOGICAL LABORATORY
BRANCH OFFICE NEW YORK
BRANCH OFFICE BOSTON
BRANCH OFFICE CHICAGO
BRANCH OFFICE SAN FRANCISCO
BRANCH OFFICE PASADENA
BRANCH OFFICE LONDON

Admiral FURTH. This is our organization prior to the Gates report.

The Office of Naval Research has a Chief of Naval Research. I am now Chief of Naval Research.

I have two deputies. One deputy and assistant chief is military, for administrative purposes; and there is a deputy and chief scientist. Dr. Piore's name has been mentioned. He is the chief scientist. Dr. Piore is in charge of all of the area which has to do with research.

Mr. RIEHLMAN. Admiral, let me get this straight. This is the new chart?

Admiral FURTH. No, sir; this is the old.

Mr. RIEHLMAN. This is the old.

Admiral FURTH. Yes, sir.

Mr. RIEHLMAN. The way it originally was working?

Admiral FURTH. Yes.

Mr. BALWAN. And still works.

Mr. RIEHLMAN. And still is working.

Admiral FURTH. Yes; the way it still is working. We are just imposing additions on this organization and not changing the organization at all.

Mr. RIEHLMAN. All right.

Admiral FURTH. We have policy committees which Mr. Smith has mentioned.

The Naval Research Advisory Committee is our chief committee, in conformity with Public Law 588.

We have a Naval Research Facilities Review Board. It has always been the function of the Office of Naval Research to review all capital facilities and investments for the entire Navy Department in research and development, and make our recommendations on the bureau proposals, as to whether or not facilities should be added to any activity.

Mr. RIEHLMAN. Maybe this information has been given, but who composes this board?

Admiral FURTH. Well, the Chairman of the Board is the Deputy and Assistant Chief of Naval Research. The members of the Board are from the bureaus of the Navy Department. They make the recommendations to the Chief of Naval Operations for facilities review.

We have the Inventions Evaluation Board, where we evaluate the inventors' ideas which come to us in letters, and handle a large amount of correspondence of that nature.

Now that the Council which formerly was active under Mr. Kettering is rather inactive, since the war ended, we do that.

Then we have our comptroller, who is responsible for all of our fiscal operations and for the administration of the consolidated Research and Development Navy Appropriation, which is new this year, as changed by the House Appropriations Committee.

We have a contract division which makes the contracts with the universities, nonprofit laboratories and industrial laboratories for work conducted under contract.

This division, my office, does all of the contracting with the universities, whether the money is supplied by a bureau or by the Office of Naval Research. The contract itself is handled and administered through the Office of Naval Research. That is, therefore, a uniform policy in dealing with the scientists for research.

Mr. COTTER. Does your office also let all research and development contracts?

Admiral FURTH. No, sir; the bureaus let their own contracts.

We have our usual Personnel and Agencies Division for handling personnel matters; and then we have a Military Services Division for the military personnel in our office.

Now, the real function of the office is this block here, the Assistant Chief for Research, and Science Director. That is the actual contract program. This is our contract program in basic research.

This work is under an assistant for research; and a civilian scientist with a very good national reputation.

Mr. BALWAN. Who is it?

Admiral FURTH. Dr. Robertson.

These blocks are filled. Except for the Naval Science Division the staffing is primarily civilian. The heads of all the divisions are civilians, but we have a few junior ranks of the military officers, naval officers, in the divisions. They are officers who have specialized in the particular science and have had graduate education and they are giving them an opportunity to actually work in the science while they are in the junior ranks, before they have to move out into administrative jobs.

Mr. BALWAN. They are all contract research; is that not right? This would be supervisory work?

Admiral FURTH. This is administration; that is right. This is administration of contract research.

This portion represents our coordination effort, because the bureaus are interested in mathematics, physics, chemistry, oceanography, geography, and so on. They have small programs which they finance themselves.

We have established a coordinating area, and we have panels with the membership of the bureaus interested in the particular sciences, and we work out a program which in research will cover the areas of intense interest and immediate interest to the Navy.

The bottom line shows some of our field activities. We have the Naval Research Laboratory, the Special Devices Center, the Underwater Sound Reference Lab, the Navy Biological Laboratory; and branch offices at New York, Boston, Chicago, San Francisco, Pasadena, and London.

Those offices are for the purpose of administering at close-aboard contracts within the geographical areas, with the exception of the branch office in London, which is a listening post and covers all of the science going on not only in Great Britain but also on the Continent, the headquarters being in London.

Mr. COTTER. Suppose a contract is given to private industry for development of research on a fire-control device. What does your office have to do with it?

Admiral FURTH. We would make the contract, administer the contract, and we would monitor the work. We do not direct the work, but we would go into the plant from time to time. We would have conferences with the contractor.

Where we would see areas where we would have knowledge of technology developed on some of our other contracts, our main function is to keep any new information flowing into the contractor, if it will help him in discharging his obligation.

Mr. COTTER. When you say you would make the contract, what do you mean? I thought you just told us it was up to the Bureau.

Admiral FURTH. I misunderstood you, sir. I thought you said all development contracts. I make only those contracts for applied research and development which are financed out of the funds in my portion of the appropriation. I only administer those.

Mr. COTTER. Are there research contracts which are financed from one of the other bureaus?

Admiral FURTH. Yes, sir.

Mr. COTTER. Are they administered solely by those Bureaus?

Admiral FURTH. No, sir; generally they are administered by us. Occasionally, if it is a special area, we may delegate our authority to the Bureau, to allow them to administer that particular project.

Generally we try to keep it in our office for this reason: That you create confusion in a university or a nonprofit laboratory if you have a large number of people coming in from different organizations, all talking about the same general area, but maybe their authority being limited to a specific project. It is very difficult to define by projects. You are really talking in terms of discrete areas of science when you go into these universities. One group can do a better coordination job.

One of our principal jobs in the Office of Naval Research is the collection and dissemination of scientific and technical information. That is a part of administration.

Mr. COTTER. What percentage of the development contracts would you say were awarded and processed or administered by the Bureaus themselves?

Admiral FURTH. I am afraid I did not quite understand.

Mr. COTTER. What percentage of the contracts for research and development were awarded and administered by the Bureaus themselves; where you delegated your authority to them?

Admiral FURTH. Where it happens to fall in the research area is the only area that I withhold the right.

Mr. COTTER. I am talking about the research area.

Admiral FURTH. Oh, you are talking about the research area. There is only one area at the moment where the direct administration is by a Bureau, and that happens to be in hydromechanics. This was an agreement we made some 2 or 3 years ago. As of today, now we are coming back and the Bureau is going to drop out and we will take over the administration of that area.

Mr. COTTER. Then it is a rare exception?

Admiral FURTH. It is a rare exception.

Mr. COTTER. That a development contract comes under a Bureau.

Admiral FURTH. The development contracts are under Bureaus. On the research contracts it is a rare exception when we do not administer it.

Mr. COTTER. I wish you would make that definition a little clearer as between research and development. Let us say that they have some idea of a fire-control device, but they award it out to private industry and say, "Develop this and perfect it up to a prototype." Now they have to take it from way back. Is that still in the category of the development contract?

Admiral FURTH. That is in the category of the development contract. It is very hard to make a clean differentiation between re-

search and applied research and development. There is a twilight zone in each case.

But basic research essentially is a probing of the frontiers of science for new knowledge, new technology, new information on what makes this world go round.

Applied research is directed. You want to achieve a specific purpose. You have an objective. The technology is available but you have to start almost from scratch with that technology to instrument the answer. That is what we call applied research.

It may end up, let us say, as a breadboard model of a piece of equipment which demonstrates certain principles, and those principles will suffice to help solve the overall problem. Well, you bring those together and then you begin to think in terms of a piece of equipment that would go aboard ship or in an aircraft. That becomes a development. That becomes primary engineering.

Mr. COTTER. Under your new recommendation, where the functions of the Assistant Secretary for Air have been extended to development, does your function spread to the administration of these development contracts?

Admiral FURTH. We will not; not in the administration; no, sir. Our functions are spread to the technical evaluation of the work that is going on; to advise the Secretary where we think the work could be strengthened, where we feel that a job, for instance, which is being done by one Bureau might well suffice for some work that another Bureau would like to initiate.

Mr. COTTER. Is that carrying out the full sense of the recommendation as originally made?

Admiral FURTH. I believe it is, sir. I think the Secretary could answer that better. I feel it is carrying out the full sense.

Mr. SMITH. I think so. I see the problem you have in back of your mind. I think we are all right.

Admiral FURTH. Actually, when one reads the Gates report, it is not a recommendation to throw away everything that is working. It is to supplement what you have been doing and to strengthen it and to assist in the strengthening.

In the area where we felt we needed the strengthening—I think that was the feeling of the Gates committee—it was the technical evaluation of these programs by a third party. We hope that we are the third party that will be able to see the forest for the trees.

Mr. MCCORMACK. When it gets to the development stage, under whose jurisdiction, so far as the Assistant Secretaries are concerned, does it come then, Admiral?

Admiral FURTH. It stays under the Assistant Secretary for Air through the development stage.

Mr. MCCORMACK. In other words, the basic, applied, and development stays under Secretary Smith?

Admiral FURTH. That is correct.

Mr. MCCORMACK. Then when it gets to development under whom does it come?

Admiral FURTH. When it gets to developing the prototype for production it moves under the Assistant Secretary for Material, Mr. Fogler. That becomes a production item.

The beauty of it, as we see this type of an organization, is the fact that the administration of that development is within the Bureau

itself. It stays in that Bureau. It is developed and goes on to production. It is produced. It is installed and it is maintained by the same closely knit organization. So the product is right there from the idea, from the conception of an idea, almost, until it goes out of existence and becomes obsolescent or obsolete and is removed. It does stay within that Bureau over the spell.

We provide the technology, the information that flows into the Bureaus, for them to generate these problems in the development of weapons and weapons systems.

Mr. LIPSCOMB. At what point do you consult with the Assistant Secretary of Defense, Research and Development?

Admiral FURTH. That is a continuous association. It is carried on constantly by our membership in the military, the Navy membership. For instance, on his coordinating committees, which go over the three military programs and bring them into consonance and eliminate duplicative work, they study that.

We assist in technical information to the technical panels he has serving him. The budget cycle is something that goes on all the time. This is part of the budget cycle. You have to review the program constantly, and as you review the program, you make modifications in your shopping list for your budget request, and also in the shopping list in the obligation of funds.

This must go on constantly. This is very dynamic. Research and development must be dynamic and kept dynamic.

Mr. MCCORMACK. What is done in connection with the duplication between different branches of the armed services?

Admiral FURTH. We try to eliminate that, sir, at the working level. When a project is initiated by a service it is the responsibility of the initiating service to get in touch with the other services and find out whether or not they have a similar project or something that will satisfy their needs.

There is a special block in the Department of Defense form which calls for that coordination. Before it reaches Mr. Quarles' level in the Department of Defense that preliminary coordination has been accomplished. Then it is looked into again by the Coordinating Committee.

Mr. MCCORMACK. And assignment is made to a particular service, if assignment is made or if a particular service requests it. Then it is reviewed in connection with the other services?

Admiral FURTH. Yes, sir.

Mr. MCCORMACK. To see if there is any duplication and so forth?

Admiral FURTH. We have parallel developments. They are recognized as parallel developments, because it may be a very important area and there are two separate approaches, quite different and distinct. That will be tolerated up to a certain point, but as soon as one of these begins to forge ahead the other one is ordered dropped. The service sponsoring the one that is ahead and shows the most promise continues to be the cognizant service. The other services move in and help it financially, or if they do not need funds then they come in and have a joint program for continuing development and evaluation of the item.

Mr. MCCORMACK. In other words, there is competition up to a certain point?

Admiral FURTH. It might be; yes, sir. That is not general.

Mr. MCCORMACK. I understand.

Admiral FURTH. Yes, sir. We try to differentiate between duplication and parallel attacks on some of the important military problems.

Mr. MCCORMACK. Again, that comes back to the question of direction, and so forth.

Admiral FURTH. Yes, sir.

Mr. MCCORMACK. I remember when the unification bill was up I was for the amendments for the Navy and the Marine Corps, which permitted them to still retain their proper competitive atmosphere and spirit.

Admiral FURTH. The only change that we visualize in this chart is that now we are putting in this one area where we will make the studies of all of the developments, technical evaluations, with our recommendations to the Assistant Secretary and to the Chief of Naval Operations.

Mr. COTTER. Pardon me. Do all recommendations to the Assistant Secretary to go ahead with work come through your shop? Is it possible for something to come up through one of the Bureaus and go directly, or must it flow through your shop?

Admiral FURTH. Not from the bureaus. As I visualize the operation, it will come through our shop. We are the focal point for technical and budgetary processes, for the Secretary.

However, under this other chart the bureaus have a membership. The Chief of Naval Operations has a membership on the R. and D. Committee to channel the protests on any recommendations, or reclamas on suggested budgetary action.

Mr. COTTER. But the normal flow is through your shop?

Admiral FURTH. The normal flow would be through our office, although when it comes to the reclama they would go direct to the Secretary's Office. I expect that would be referred to the Board for discussion.

We make no changes except for the operational research. We have removed the operational research from this group because now the operational research has to serve two purposes. It has to serve the people doing research and it has to serve the people doing the coordinating function of development.

We do not visualize any material increase in the staff. We are asking for 20 people now to take care of our additional budgetary responsibilities and coordinate it, but we want to start very carefully. We feel if we do a meticulous job in 1 or 2 areas this first year that that will be of great advantage to the Navy. We will gradually expand our activities. It is going to take quite a little time to be able to cover the whole program, but once we get moving in, this will be under constant survey. This will be a day-to-day operation and not an annual operation.

I visualize the budgetary cycle being cut down considerably and it will be performed on a day-to-day basis, rather than on a time schedule.

Mr. MCCORMACK. I have just 1 or 2 more questions.

Is it your opinion that the field of research, military research, and that means all of the field, all of the activities, are of vital concern to our country?

Admiral FURTH. There is no question about that.

Mr. MCCORMACK. No question about that.

Admiral FURTH. No.

Mr. McCormack. And that requires not only trained military, but trained scientists and their loyalty and their willingness to make sacrifices, and I know the devotion of your men, and I respect very much your making sacrifices, and that applies to your families too.

But is it your opinion that, from the military angle, that the maximum of results in teamwork with scientists, and the scientists in teamwork with military, that time is gained when the commanding officer, and as many other officers as possible, with the commanding officer in charge of the laboratory or any particular project, or any other activity, is a man who has had experience in the field of science, in related fields, and that it is for the best interests of all of the services, and the Armed Forces, that that type of officer be assigned to the responsibility in the field of science?

Admiral Furth. Very definitely.

Mr. Riehlman. Any other questions?

Mr. Balwan. I had 1 or 2 questions—it was mentioned in the discussion with the Secretary, concerning the questions which the subcommittee submitted to you, that you will refer them to the Research and Development Advisory Committee—is that correct?

Mr. Smith. No; I said we plan to do that.

Mr. Balwan. Oh; you plan to do it?

Mr. Smith. Yes. At their next meeting; and they will see the type of questions that have been raised here, and get their opinions on the answers.

Mr. Balwan. You say you plan to submit them at the next meeting?

Mr. Smith. Yes.

Mr. Balwan. Mr. Chairman, I think it would be helpful to the subcommittee if we could see how this Advisory Committee reacts, what their reactions are in any way.

Mr. Smith. How soon would you want that sort of answer?

Mr. Balwan. When is your next meeting?

Admiral Furth. We just had one last week, and we would not be due to have another one for perhaps 2 months.

Mr. Smith. We could get you a few members of the committee in areas, to give you a quick reaction.

Mr. Riehlman. I do not think that would be of particular value; I think we should have the overall response of all of the members of the Advisory Board.

Admiral Furth. It is very difficult to get all of these members together; they come from the west coast, as far away as——

Mr. Riehlman. I would think it would be very helpful to have it, but as long as it is going to be some time away——

Mr. Balwan. I thought that it would be helpful if the subcommittee had it, and I was thinking the next meeting would be in the near future.

Now, you gentlemen, I believe, have testimony from some other gentlemen tomorrow. I would like to ask something about the organization, and I understand there is a chart on that matter.

Mr. Riehlman. Do you have a chart covering that?

Admiral Furth. Yes; I have a chart of the special branches here.

Mr. Riehlman. You have that here?

Admiral Furth. Yes; I have that chart here.

Mr. RIEHLMAN. Well, I think it is getting a little bit late, and I think we will adjourn for tonight, unless there are some questions the members wish to ask the Secretary or Admiral Furth. It is a little bit difficult to set an hour as to when we could hear the other witnesses. Tomorrow morning the full committee meets and tomorrow afternoon we have legislation on the floor under the 5-minute rule, which many members are very much interested in.

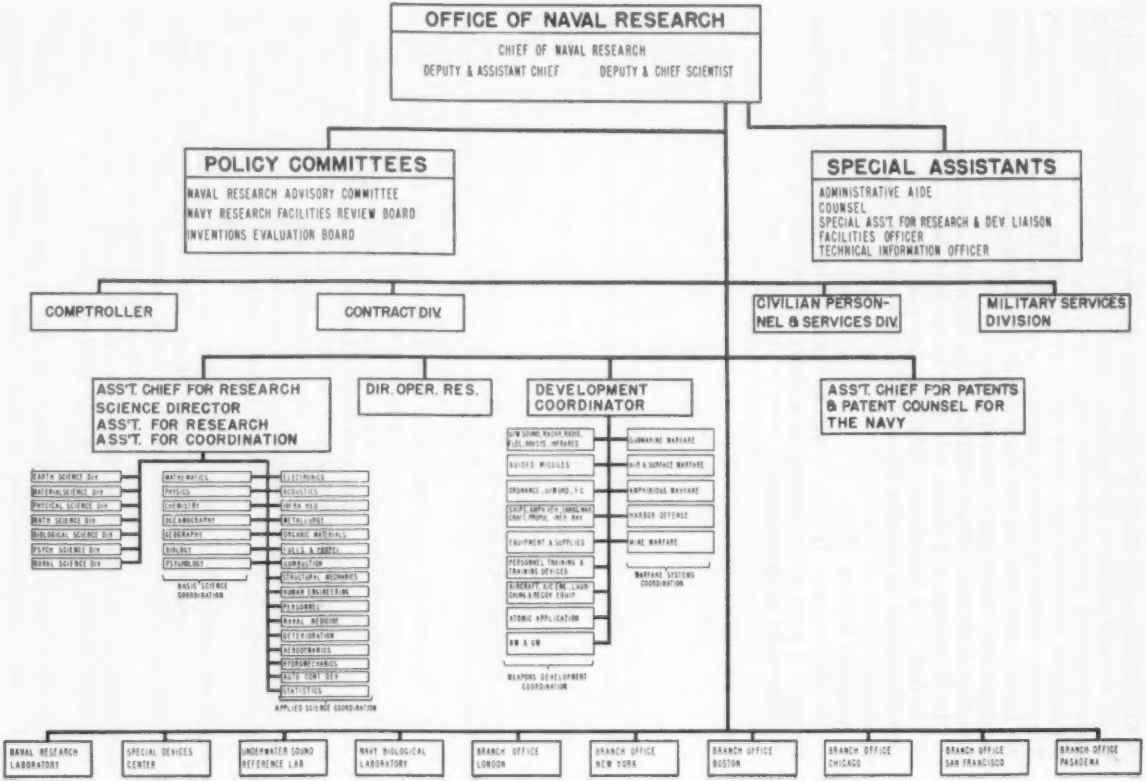
Admiral FURTH. May I leave copies with the committee?

Mr. RIEHLMAN. I think it might be well if you would do so; and if we feel it is necessary, Admiral, for you to come up for a brief period of time to explain them, the subcommittee may call upon you to do so.

Admiral FURTH. Yes.

Mr. RIEHLMAN. If not, it will be inserted in the record, or at least be made a part of the record, as a chart.

(The chart is as follows:)


OFFICE OF NAVAL RESEARCH
CHIEF OF NAVAL RESEARCH
DEPUTY & ASSISTANT CHIEF
DEPUTY & CHIEF SCIENTIST
POLICY COMMITTEES
NAVAL RESEARCH ADVISORY COMMITTEE
NAVY RESEARCH FACILITIES REVIEW BOARD
INVENTIONS EVALUATION BOARD
SPECIAL ASSISTANTS
ADMINISTRATIVE AIDE
COUNSEL
SPECIAL ASST. FOR RESEARCH & DEV. LIAISON
FACILITIES OFFICER
TECHNICAL INFORMATION OFFICER
COMPTROLLER
CONTRACT DIV.
CIVILIAN PERSONNEL & SERVICES DIV.
MILITARY SERVICES DIVISION
ASS'T. CHIEF FOR RESEARCH
SCIENCE DIRECTOR
ASS'T. FOR RESEARCH
ASS'T. FOR COORDINATION
DIR. OPER. RES.
DEVELOPMENT COORDINATOR
ASS'T. CHIEF FOR PATENTS & PATENT COUNSEL FOR THE NAVY
EARTH SCIENCE DIV
MATERIALSCIENCE DIV
PHYSICAL SCIENCE DIV
MATH SCIENCE DIV
BIOLOGICAL SCIENCE DIV
PSYCH SCIENCE DIV
NAVAL SCIENCE DIV
MATHEMATICS
PHYSICS
CHEMISTRY
OCEANOGRAPHY
GEOGRAPHY
BIOLOGY
PSYCHOLOGY
BASIC SCIENCE COORDINATION
ELECTRONICS
ACOUSTICS
INFRA RED
METALLURGY
ORGANIC MATERIALS
FUELS & LUBES
COMBUSTION
STRUCTURAL MECHANICS
HUMAN ENGINEERING
PERSONNEL
NAVAL MEDICINE
DETERIORATION
AERODYNAMICS
HYDROMECHANICS
AUTO CONT. DEV.
STATISTICS
APPLIED SCIENCE COORDINATION
SUBMARINE WARFARE
A-S & SURFACE WARFARE
AMPHIBIOUS WARFARE
HARBOR DEFENSE
MINE WARFARE
WARFARE SYSTEMS COORDINATION
WEAPONS DEVELOPMENT COORDINATION
NAVAL RESEARCH LABORATORY
SPECIAL DEVICES CENTER
UNDERWATER SOUND REFERENCE LAB
NAVY BIOLOGICAL LABORATORY
BRANCH OFFICE LONDON
BRANCH OFFICE NEW YORK
BRANCH OFFICE BOSTON
BRANCH OFFICE CHICAGO
BRANCH OFFICE SAN FRANCISCO
BRANCH OFFICE PASADENA

Now, I think the Chair will adjourn the meeting for tonight, with the understanding that if there is a possibility tomorrow to hear these other two men, we will try to work them in somewhere. These witnesses, I think, will be on call so we can get them any time they are wanted. But we will wait and see what transpires in the full committee tomorrow morning and how long that takes, and we should be able to get out of here by 11 o'clock. We might try to get 1 or 2 of those witnesses before we really get into the actual program in the House, and maybe we can work the other 1 in sometime in the afternoon.

The committee will adjourn, subject to the discretion of the Chair, and we will proceed along that line.

I want to thank you, Mr. Secretary and Admiral, for your splendid presentation here this afternoon and the manner in which you have very carefully and forthrightly answered the questions which have been propounded to you.

Mr. SMITH. Thank you very much, Mr. Chairman; it has been a very interesting session.

(At 6:06 p. m., the hearing was adjourned to meet subject to the call of the Chair.)

ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

WEDNESDAY, JUNE 9, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON MILITARY OPERATIONS OF THE
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met at 4:10 p. m., in room G–53, United States Capitol, Hon. R. Walter Riehlman (chairman of the subcommittee) presiding.

Mr. RIEHLMAN. The subcommittee will come to order.

I would like for the record to show that Mr. Ikard and Mr. Riehlman are present; and Mr. McCormack will be here, as well as Mr. Lipscomb.

This is a continuation of the subcommittee's hearing on research and development in the Defense Department.

This afternoon we are delighted to have with us three outstanding scientists in this field. Because of the importance of these gentlemen's testimony, we are going to ask them to be sworn.

Doctor, are you going to be the first one to testify?

Mr. BALWAN. Mr. Bruce Eaton.

Mr. RIEHLMAN. Will you raise your right hand. Do you solemnly swear the evidence given before this committee will be the truth, the whole truth, and nothing but the truth, so help you God?

TESTIMONY OF BRUCE G. EATON, JR., TECHNICAL DIRECTOR, SPECIAL DEVICES CENTER, OFFICE OF NAVAL RESEARCH, SANDS POINT, LONG ISLAND, N. Y.

Mr. EATON. I will.

Mr. RIEHLMAN. Now, Mr. Eaton, you do not have a prepared statement?

Mr. EATON. No.

Mr. RIEHLMAN. Mr. Eaton, you are going to give us testimony in respect to the research and development activities within the Navy; am I correct in that?

Mr. EATON. Correct.

Mr. RIEHLMAN. Yes, sir. All right; you may proceed. Do you have any questions you want to ask, Mr. Balwan?

Mr. BALWAN. Why do I not start off by getting him on the record with his experience.

Mr. RIEHLMAN. Fine.

Mr. BALWAN. Mr. Eaton, will you tell the committee what your experience is, so that we can have it on the record?

NOTE.—Asterisks denote classified material deleted.

Mr. EATON. I graduated from the University of Illinois in 1930 with a bachelor of science in electrical engineering; the Massachusetts Institute of Technology in 1932 with a master's degree of aeronautical major. I immediately started work in the Curtiss-Wright Corp., which company I worked for for 16 years.

The first 2 years, until 1934, I was doing mainly engineering design layout work; or, in other words, apprentice aeronautical engineering work.

For the next 3 years I was in charge of the Curtiss wind tunnel and model shop, which, I might add, was the one commercial wind tunnel operation at that time.

From 1937 to 1941 I was assistant project engineer and project engineer and worked on Navy Scout observation airplanes; on which the rest of my airplane design work was classed as my specialty.

From 1941 to 1945 I was senior project engineer and development engineer for military aircraft. During this time I continued the operation of design there, putting into production two Scout observation seaplanes for the Navy.

Mr. BALWAN. Mr. Eaton, did you design these planes?

Mr. EATON. Yes. One of which was conceived, designed, and put in production and saw combat during our active participation in the war.

Mr. BALWAN. Did you just design a part of this plane, or were you responsible for the design of the whole plane?

Mr. EATON. Responsible for the design of the whole plane.

Mr. BALWAN. Did the plane go into production also during the war?

Mr. EATON. Right.

Mr. BALWAN. What kind of a plane was it?

Mr. EATON. Scout observation, known as the SC–1 and SC–2.

Mr. BALWAN. Proceed.

Mr. EATON. From 1945 to 1948 I was chief design engineer of pilotless aircraft. This included both drone-type airplanes and guided missiles. During this period I had contracts for design studies in guidance systems developments for the Air Force and for the Navy; and within the Navy , the Bureau of Aeronautics and the Bureau of Ordnance. I was in from the beginning of the well-known "Bumblebee" program.

Mr. BALWAN. What was the "Bumblebee" program, Mr. Eaton?

Mr. EATON. The "Bumblebee" program ended up being the Bureau of Ordnance missile Terrier.

Mr. BALWAN. You worked on this where?

Mr. EATON. I worked on this with Curtiss, the Curtiss airplane division of the Curtiss-Wright Corp. June 1948, I left Curtiss. This was the beginning of the closing out of the airplane division of the Curtiss-Wright Corp.

In my deciding what next to do I was negotiating with industry, at which time some friends of mine in the Naval Air Development Center asked me at the last moment to come down and look over a proposition they had there. The price differential was somewhat in favor of industry, but it looked like there was considerable activity in one of the laboratories in the Naval Air Development Center, and I decided to accept that position. That was the associate director of the Pilotless Aircraft Development Laboratory. That consisted of most all investigations that were done by the Bureau of Aero-

nautics, since we were directly under the more or less technical cognizance of the Guided Missiles Division, Bureau of Aeronautics.

This lasted until January 1950, at which time the commanding officer set up a new group to be known as the Analytical Computer Group, which was somewhat of a staff operation in comparison with the rest of the laboratories, but nevertheless it was a group to work, something on the order of operations research on the one hand, and on the other hand operating a large analog computer known as Typhoon.

This lasted until September 1951, at which time I went to the Special Devices Center as technical director.

Mr. BALWAN. May I ask a question here? Your experience in the Navy at Johnsville was at the Navy Air Development Center, which is part of what bureau of the Navy?

Mr. EATON. The Bureau of Aeronautics.

Mr. BALWAN. The Bureau of Aeronautics. You were going from the Bureau of Aeronautics to another laboratory, which is part of what bureau?

Mr. EATON. I was going to the Special Devices Center, which is under the Office of Naval Research. That was in September 1951. That brings us up to the present time.

Mr. BALWAN. Mr. Chairman, may I suggest that we request that this be introduced in our hearings?

Mr. RIEHLMAN. You may request it, and if there is no objection it shall be entered as such.

Mr. IKARD. That is this document [exhibiting document]?

Mr. RIEHLMAN. Yes.

(The document was received and is as follows:)

EXPERIENCE RÉSUMÉ OF BRUCE G. EATON, JR.

Born: Greeley, Colo., June 9, 1909.

Degrees: University of Illinois (1930), B. S. in electrical engineering; Massachusetts Institute of Technology (1932), M. S. (aeronautics major).

Work experience: Curtiss-Wright Corp., airplane division, Buffalo, N. Y., and Columbus, Ohio, 16 years; United States Government, 5½ years: Naval Air Development Center, Johnsville, Pa.; Special Devices Center, Sands Point, Long Island, N. Y.

Suggested references

Curtiss-Wright Corp. period.—Mr. T. P. Wright, vice president, Cornell University, Ithaca, N. Y.; Mr. Walter Tydon, chief engineer, Fairchild airplane division, Hagerstown, Md.

United States Government period.—Naval Air Development Center: Adm. S. Spangler, COMAIRLANT, Naval Air Station, Norfolk, Va.; Capt. H. Keopke, Naval Aircraft Factory, Philadelphia, Pa.; Dr. K. C. Black, Microwave Research Institute, 55 Johnson, Brooklyn, N. Y. Special Devices Center: Adm. Calvin Bolster, General Tire & Rubber Corp., Akron, Ohio; Capt. T. B. Haley, 5133 North 10th Street, Arlington, Va.

September 1951, to July 1954 (approximate)—Technical director, Special Devices Center, Office of Naval Research, Sands Point, Long Island, N. Y

This position is an appointment, by the Secretary of the Navy, under Public Law 313, 80th Congress (established to provide a higher wage scale than existing under current civil-service grades).

The mission of the Special Devices Center is to improve the effectiveness of naval training within the scope of authority of the Chief of Naval Research by providing training devices, teaching aids and training systems. Implementing the mission by studying and recommending new training techniques and conducting research and development in support of the mission.

As technical director, I exercised executive direction and technical leadership over the departments at the center responsible for the technical operations as follows:

Military requirements.—Obtaining training requirements and defining the scope and objective, resulting in a summary called Military Characteristics.

Human engineering.—Conducts research and provides services in the advancement of "transfer of learning" for all training devices, aids and techniques.

Engineering research and development.—Provides the overall engineering talent for the center's operation. Supporting research, project development and production and maintains operation of center shop and laboratories.

Contracts.—Conducts all negotiations and paperwork for projects up to the final contracting authority of the Office of Naval Research or the Naval Purchasing Office (New York).

Field services and publications.—Provides installation and maintenance for all prototype and production training devices. Supplies necessary manuals for devices and collects device utilization data.

The technical operation consists of supporting research, design, development, production, evaluation, installation and maintenance.

Statistics on this operation are as follows using rounded figures as averages:

Active projects (all categories)	500
Direct operating personnel	320
Moneys: [1]	
Research and devlopment	5, 000, 000
Production	10, 000, 000
Installation and maintenance	3, 000, 000

[1] The agencies involved are "across the board" in Defense Department and number approximately 12.

January 1950 to September 1951—Technical director, Analytical and Computer Group, Naval Air Development Center, Johnsville, Pa.

The initial duties of this position were to organize and staff a new group of approximately 30 engineers, at the request of the commanding officer.

As technical director of the Analytical and Computer Group (ACG) I exercised technical and administrative direction of ACG which is engaged in the performance of—

(*a*) Solutions by means of large and versatile electronic analogue (Typhoon) and digital computers and electronic flight simulators to the complex problems in the field of engineering, research and developmental activities associated with the Department of Defense with emphasis on naval aviation and guided missiles;

(*b*) The development of new computational and simulation methods and equipment to meet the growing needs of the Department of Defense;

(*c*) Systems engineering analysis and evaluations in the field of advanced aircraft engineering systems for the purpose of establishing paths for future research and development of all phases of naval aviation, e. g. airframes, propulsion, armament, guidance and control, operational tactics, etc., and

(*d*) The achievement of new and/or improved concepts for more efficient prosecution of naval warfare.

I was the principal adviser to the commander, Naval Air Development Center (NADC) concerning the activities of ACG and matters concerning the broad aspects of proper research and developmental trends for naval aircraft and associated systems. I served on top level national military and technical planning boards such as the Research and Development Board (RDB).

I was responsible for technical direction and coordination of work of the two divisions of ACG, the Computor Division and the Engineering Systems division, since a large portion of the work of each division relates to and requires the service of the other division.

September 1948 to January 1950—Associate director, Pilotless Aircraft Development Laboratory, Naval Air Development Center, Johnsville, Pa.

As associate director I acted as scientific consultant and adviser to the director of the laboratory. I maintained liaison with scientific institutions, Government laboratories, industry and other Government agencies whose research and development relate to guided missiles. My advisory and coordinating services were from time to time, called upon by BuAer. I was a member of the test equipment panel of the Research and Development Board's Guided Missile Committee.

The mission of the laboratory was to cope successfully with the many peculiar and unique technical problems encountered in the operation of pilotless aircraft

and guided missiles from ships and shipborne aircraft. The Navy provided suitable technical developmental services for the scientific investigation and the development of special experimental aircraft, missiles and equipment, necessary to the solution of these highly specialized problems. This was done in order to enable actual workable prototypes of naval pilotless aircraft and guided missiles to be developed either commercially or otherwise, within minimum time and cost. The commercial pilotless aircraft and guided missile field, the Bureau of Aeronautics, and all other interested agencies, must have recourse to a continuing naval development agency, with highly qualified capacity and experience to provide these technical developmental services on a basis commensurate with long range-naval planning. The laboratory was originally established to serve as this agency, and was the only facility of such nature available to the Bureau of Aeronautics. The operating personnel consisted of approximately 400, about half making up the engineering departments.

December 1945 to June 1948—Chief design engineer, pilotless aircraft, Curtiss airplane division, Columbus, Ohio.

My duties in directing the corporation's missile programs consisted of keeping abreast of all research and development in the guided missile field and directing a technical group in applicable research and development tasks. A major portion of my time was consumed in monitoring all current missile projects and maintaining close liaison with all agencies performing research in the fields of aerodynamics, propulsion, guidance (electronic and mechanical) launching, trajectories, ordinances, and airframes. I applied this diversity of data in directing the technical group in original and advanced research and development in such all encompassing tasks as follows:

Air Force.—

(*a*) Long range surface-to-surface missile—technical and design studies.

(*b*) Short range surface-to-surface missile—technical and design studies.

(*c*) Long range air-to-surface missile—technical and design studies.

(*d*) Inertial guidance systems—technical studies, design and manufacture of high-precision gyroscopes, integrating accelerometers, serve systems, and electronic and electrical computers.

Navy.—

BuAer:

(*a*) Medium range air-to-surface missile (2 types) technical and design studies.

(*b*) Pulse jet target drones (KD2C–1)—designed, developed, manufactured, and test flown.

BuOrd—"Bumblebee" program of Applied Physics Laboratory:

(*a*) Launching methods. Technical studies and launching computer; developed and manufactured.

(*b*) Perforated ram jet—design, wind tunnel model constructed and tested.

(*c*) Component design. Components were designed and developed for guidance and telemetering.

The technical personnel involved in this operation were approximately 65, exclusive of technicians and drafting services.

May 1941 to December 1945—Senior project engineer and development engineer—military aircraft. Curtiss airplane division, Columbus, Ohio, and Buffalo, N. Y.

During the beginning of this period I was responsible for getting into wartime production the Navy scout observation airplanes (SO3C–1 and SO3C–2). After advancing to development engineer my responsibility covered the initial design and development of a new Navy dive bomber as well as the scout observation type (XBTC–1, SC–1, and SC–2). Under pressure of war, collateral duties were added, to direct the scout observation (SC–1) through Navy acceptance trials and initial fleet shakedown operation. After transfer to the Buffalo factory as development engineer—military aircraft, I was responsible for new Air Force aircraft, naval aircraft and guided missile designs. With the voluminous quantity of war expedited basic and applied research data plus an inflow of similar data from Germany, a large portion of my time was used for sifting and interpreting those data into developmental designs both in aircraft and guided missiles. I participated in the initial surface-to-air missile programs of BuAer (LARK) and BuOrd (BUMBLEBEE) and maintained close liaison with the scientific agencies in the missile field. I directed design studies and submitted guided missile proposals resulting in the contracts mentioned in the following section where they were prosecuted on closing of the Buffalo factory.

June 1937 to May 1941—Assistant project engineer and project engineer, Curtiss Airplane Division, Buffalo, N. Y.

During the initial period I prepared new military and design proposals. A scout observation (XB03C) for the Navy was accepted and I was advanced to project engineer responsible for its development, flight and Navy acceptance tests. On completion of this experimental program the responsibility was given me for the production design of the airplane (S03C–1 and S03C–2) and its transfer for manufacture to a new wartime factory in Columbus, Ohio.

November 1934 to June 1937—Aerodynamicist in charge of Curtiss wind tunnel, Curtiss Airplane Division, Buffalo, N. Y.

During this period I was in charge of the Curtiss 8-foot wind tunnel and accompanying model shop. In this position I was responsible for the aerodynamic design of all new aircraft which during this period consisted of seven new models. Concurrently, I initiated basic aerodynamic research programs which were transposed into practical applications to improve military aircraft aerodynamic performance. I designed and manufactured the first fully automatic wind tunnel balance used in an industrial organization (Aero Digest—April 1937).

July 1932 to November 1934—Aeronautical engineer, Curtiss Airplane Division, Buffalo, N. Y.

During this period, I performed engineering design and layout work on military aircraft working up to engineer in charge of design on major portions of several military aircraft (XF12C–1, XF13C–1, X03C–1, S0C–1).

Mr. BALWAN. Mr. Chairman, Mr. Eaton has had a very broad and extensive experience in these laboratories. The last position he mentioned, where he was the chief scientist at the center, he is prepared to give us a story on. It really is a case study of what happens when the military does try to get into the picture.

We have heard testimony yesterday from Navy officials, which stated that it is not possible for this kind of thing to happen. I think that the case study which he will reveal is an example of how they go about doing it.

Mr. RIEHLMAN. Well, I think it would be most important for the committee to have that complete information. We will be delighted to.

Mr. IKARD. Mr. Eaton, are you presently with the Navy or have you terminated your duty?

Mr. EATON. I am presently still technical director. My resignation has been submitted and will be effective as of July 3.

Mr. IKARD. Yes.

Mr. BALWAN. Will you proceed, please?

Mr. RIEHLMAN. Let me ask you this question, Mr. Eaton: The information you are going to give us; is that current information?

Mr. EATON. Current? You mean the present status?

Mr. RIEHLMAN. Yes.

Mr. EATON. Up to date?

Mr. RIEHLMAN. Yes.

Mr. EATON. Yes.

Mr. RIEHLMAN. Fine.

Mr. EATON. I would like to start off by giving a very brief sketch.

The mission of the Special Devices Center is to conduct research and development leading to the development of training devices. It goes further in the procurement of production devices and the installation and maintenance of these devices in the field. I might add that these devices—when I speak of them—cover the complete Defense Department, and we do procure for practically every agency within the Defense Department.

The thing that is somewhat unique about this operation is the fact that I am going to try to refer to it as a field activity of O. N. R., since there is quite a bit of controversy.

Mr. BALWAN. What does O. N. R. stand for?

Mr. EATON. Office of Naval Research. Since there is quite a bit of controversy whether this could be classed as a laboratory or as a de facto material bureau. It is true that we do more than most laboratories do, in that we do this production procurement and installation and maintenance in the field. However, we also do more than a material bureau inasmuch as we operate a photographic development laboratory, a specialized development model shop, normal laboratory facilities for electronics and mechanical construction, and a television studio plus development in that line, within the center for training purposes.

So I would still like to stay on the fence and not call it either a laboratory or a de facto bureau, because it is really neither.

Mr. BALWAN. Mr. Chairman, the significance of this controversy as to whether it is a laboratory or a development center comes from testimony yesterday, where it was stated that it is true that in an operation which is more on the research end of the spectrum it is possible to operate it under civilian control, but the minute it gets over into development then you will find more of a military center.

Mr. RIEHLMAN. Yes.

Mr. BALWAN. Mr. Eaton will point out that this has aspects of both and it is merely quibbling as to which you call it.

Mr. IKARD. They made a particular reference, as I recall it, to test centers. Mr. Eaton, would this be within that category in any sense?

Mr. EATON. To a slight respect; although normally we may bring them in for our own personal evaluation. We send them to the field for what I would call the equivalent of Patuxent or some place like that.

Mr. IKARD. What is commonly called testing you would go to the field for?

Mr. EATON. That is right. We bring them in for our own evaluation in some cases, but mostly we get the field to do that for us.

Mr. BALWAN. You do not have a Navy airfield connected with the Navy Special Devices Center, where you need a lot of military to run the airfield?

Mr. EATON. No. All we have is a couple of airplanes for flight proficiency and for cargo-taking.

Mr. BALWAN. Where is this center?

Mr. EATON. The field?

Mr. BALWAN. No. Where are you located?

Mr. EATON. The Special Devices Center is located at Sands Point, Long Island, which is very close to Port Washington.

Getting back to the center, in order to accomplish this operation we have approximately 538 civilians and 127 military. There are approximately, in the technical group, 322. These figures I cannot say are exactly current now, because of some of the very recent organizational changes, but I am reading figures that were current up to say the first of the year, or roughly there. The housekeeping and service part of it require about 216 people.

To show the order of magnitude, I am taking some figures that were current as of June 26, 1953, as being an average, because we are run-

ning a little bit higher this year. We were running quire a bit higher in fiscal 1952. They normally run in fairly good proportion.

Of the O. N. R. money, which is a block sum, $6.5 million; other R. and D. funds, which come from the Army participation group, from BuMed, and from the Air Force amounted up to $8 million. That is research and development funds.

Of that particular year the production funds which were furnished by other material bureaus and agencies in the Defense Department amounted to a little over $9 million.

Now, I would like to speak a little bit about this Army participation group. We have about 15 Army officers, and they have allocated to us 28 civilian billets, because they have no other facilities so far as the joint use with the Navy is concerned. We now have an Air Force liaison man, who spends full time there.

For operating the center above that our maintenance and operation—which is really the salary paying and so forth—runs about $3 to $3.2 million.

Mr. BALWAN. Does that include the pay of officers assigned?

Mr. EATON. No, that does not include officer or military pay. It does include their travel.

The installation and maintenance, which is a separate item—also research and development funds—which goes to maintain and install these devices in the field, runs slightly over $3 million.

As I mentioned before, this research and development money, the block of $6.5 million, the other money for the installation and maintenance and the maintenance and operation funds, are also research and development funds.

If there are no further questions as to the type of operation itself, I will go on with the more or less case history.

Mr. BALWAN. Before going into that, could you explain very briefly what you mean by production money? Do you do production work or do you contract for the production of some of these devices?

Mr. EATON. Our operation is almost entirely contract, as far as working on the dollar value is concerned. I would say in that case it might be 95 percent. However, we do run a shop, and, as I mentioned, the laboratories, totaling approximately 50—between 50 and 60, depending on how you divide some of the technicians up. That has a backlog at present of probably 100 to 150 projects.

We have on the books varying between 500 and 600 projects of all varieties, small and big ones. One device may cost a quarter cent apiece, and there may be another single device which, by the time it is all finished, including operational gear and everything, may run as high as $22 million.

Mr. RIEHLMAN. Are these contracts with industry throughout the country?

Mr. EATON. Industry; and we do have some supporting research contracts with various schools and so forth.

It has been my policy since I have been there to take and keep at least 25 percent of this block of research and development money from ONR for what I call supporting research. In other words, investigating techniques to the best of our prognostication that will be useful for future training devices.

Mr. BALWAN. So you do very little research at Port Washington?

Mr. EATON. That is right.

Mr. BALWAN. Most of your work is the supervision of these research contracts?

Mr. EATON. That is right.

Mr. BALWAN. What is the production? Do you buy certain of these devices for other bureaus?

Mr. EATON. Yes. All the production funds that I was referring to are buying devices for other agencies.

Mr. BALWAN. Devices which you developed?

Mr. EATON. That is right; which we have developed. They run on the order of 12 or 13 different agencies.

I do not know if you would just like to have a few examples here or not.

Mr. RIEHLMAN. I think it would be good to name a few of the agencies.

Mr. EATON. The Bureau of Aeronautics. The Bureau of Personnel. The Mutual Defense Aid Pact. The Marine Corps. The United States Army. The Bureau of Docks. The National Guard Bureau. The United States Air Force. The United States Coast Guard. The Bureau of Supplies and Accounts. The United States Navy Photographic Interpretation Center. The Military Sea Transportation Service. AFSWP, Armed Forces Special Weapons Project. And the Armed Services Medical Procurement Agency we have done some work for.

This varies a little bit, but it runs between 13—around 13 different agencies which, as you can see, pretty well covers the Defense Department.

Mr. BALWAN. If I could proceed into this case history of what developed——

Mr. RIEHLMAN. Yes.

Mr. EATON. In July of 1951 Admiral Bolster, the Chief of Naval Research, through the normal channels, including the Chief of the Bureau of Aeronautics, asked me to consider going to the Special Devices Center as technical director. I paid him a visit in the Office of Naval Research, and he outlined the duties of the job, and he was quite specific that the technical director was to run the technical program. He pointed out that this was completely different than I had been used to in working in a field activity of the Bureau of Aeronautics, where they have always had their military several echelons down.

This he also stressed was another point that was different, and that is that he believed in giving out block sums of money for doing the research and development type and the development of prototypes, rather than breaking it up and tying it to individual projects as dictated by ONR, such as BuAir does in their own division within BuAir for their field activities. Those were two points he stressed as being different from what I had been used to. I then made arrangements to go up and visit the Special Devices Center and arranged to be there about the middle of July, as I recall.

Mr. BALWAN. Of what year?

Mr. EATON. 1951. When Captain Burr was turning over the command to Capt. T. B. Haley. At this time Admiral Bolster repeated what he had told me in Washington, and I accepted the position. The actual appointment, signed by Secretary Whitehair, was dated September 16, 1951.

The position description that was then given contained three parts, which I think are worth entering into the record, which I would like to read. One is "Duties."

As technical director the incumbent will plan, direct, coordinate, and evaluate a research and development program in support of the mission assigned to the Special Devices Center. He will have the widest possible latitude for the technical direction of the overall research and development program. He will be the point of technical authority to the Chief of Naval Research in all fields of research and development in which the Special Devices Center engages.

The next paragraph, which I think is pertinent, is under the "Responsibilities for the work of others."

The incumbent of this position will exercise executive direction and technical leadership over the five technical divisions of the Special Devices Center; namely, engineering research and development, military requirements, field service and publications, human engineering, and contracts.

The third paragraph is under "Supervision and guidance received."

The incumbent will be administratively responsible to the commanding officer but in technical matters he will be the final authority. He will have the widest possible latitude for the technical direction of the overall research and development program.

Mr. RIEHLMAN. I would like to bring the two members, Mr. Eaton, if I can, up to date.

This is Mr. McCormack and Mr. Lipscomb, who are members of the committee.

The gentleman who is testifying is testifying under oath, Mr. McCormack and Mr. Lipscomb. He is Bruce G. Eaton, who is now in charge of the research and development program with the Navy at the Navy Special Devices Center.

Mr. EATON. At Sands Point, Long Island.

Mr. RIEHLMAN. At Sands Point, Long Island. He has given us quite a history of his background and his experience and just now was reading to us the directives that were handed to him in respect to the manner in which he should carry out his mission at the laboratory. We are up to that point. I think I have covered all that has transpired so far.

Mr. BALWAN. Would Mr. McCormack want to have read the job description that was just given to him?

Mr. RIEHLMAN. I think that would be helpful. It is just two paragraphs of the job description that he had just read into the record. It does not need to be read in again; but please read it for Mr. McCormack's information.

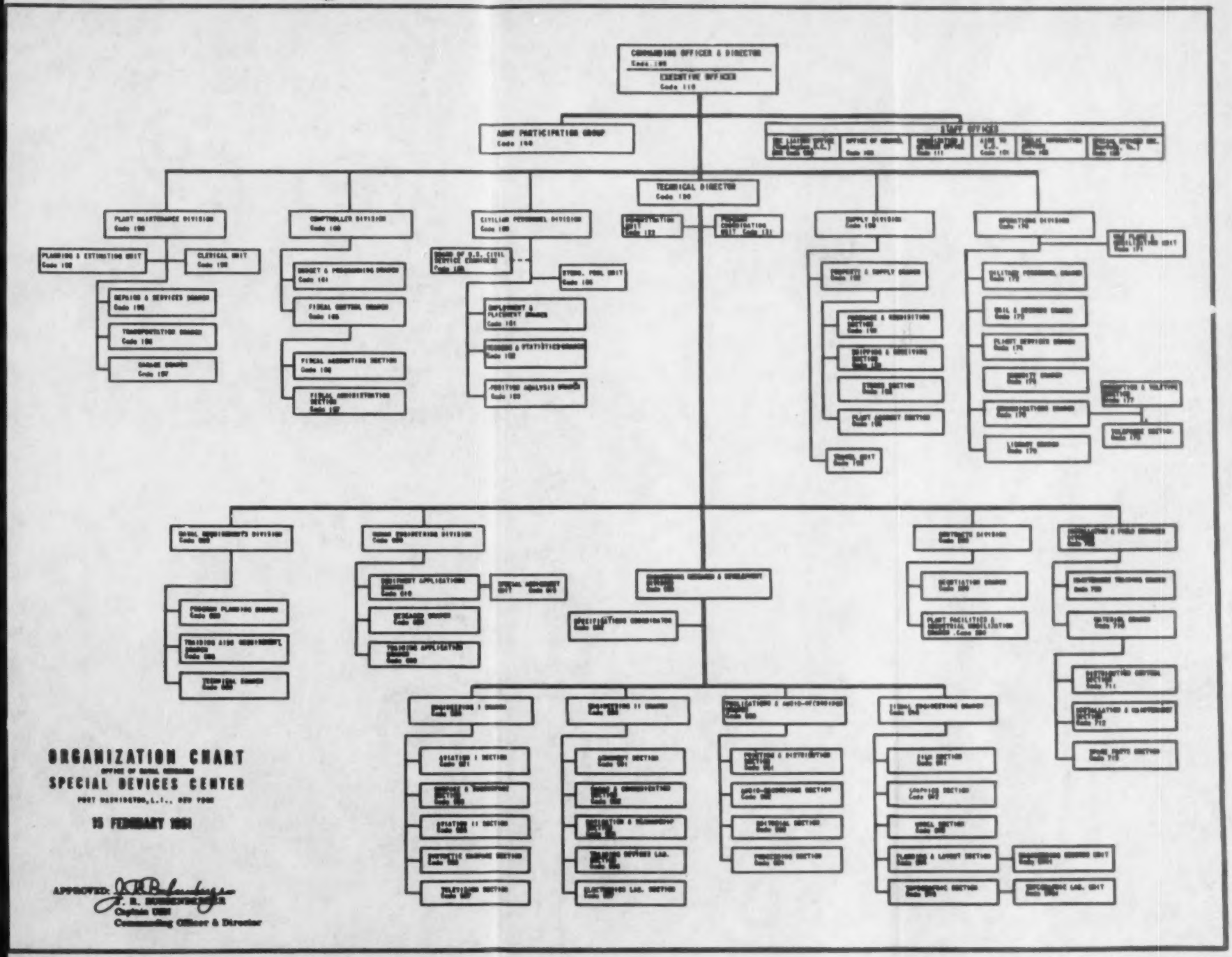
(Discussion off the record.)

Mr. BALWAN. In effect you were the No. 2 man at the center; is that right?

Mr. EATON. Well, the commanding officer except for pure technical matters.

Mr. BALWAN. You would be responsible under that job description directly to the commanding officer for all the laboratory work that was there?

Mr. EATON. That is right. I have here the organization chart—two of them, actually. One was made in February, long before I got there; and the other they were operating on as I arrived, but was not actually published until November 15, 1951, and that is chart No. F–13–C.



ORGANIZATION CHART

OFFICE OF NAVAL RESEARCH

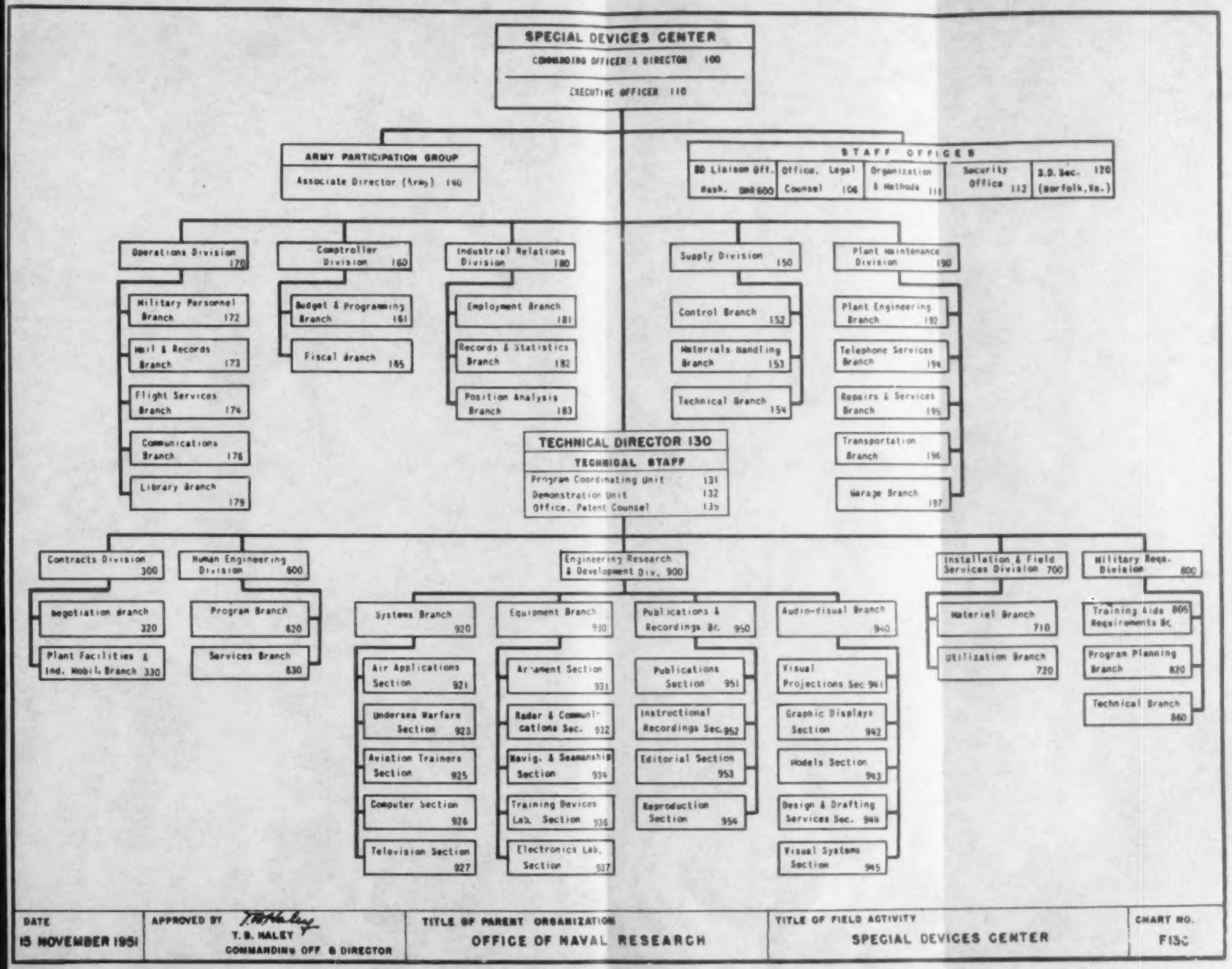
SPECIAL DEVICES CENTER

POST DISPATCHER, L.I., NEW YORK

15 FEBRUARY 1951

APPROVED: J. R. Rubendunger

J. R. RUBENDUNGER
Captain USN
Commanding Officer & Director



DATE	APPROVED BY	TITLE OF PARENT ORGANIZATION	TITLE OF FIELD ACTIVITY	CHART NO.
15 NOVEMBER 1951	T. B. HALEY COMMANDING OFF & DIRECTOR	OFFICE OF NAVAL RESEARCH	SPECIAL DEVICES CENTER	F13C

49136 O - 54 [Face p. 126) No. 2

Mr. IKARD. Mr. Chairman, may we have that chart for the record; or both of them?

Mr. RIEHLMAN. If we may have them we would appreciate it.

Mr. EATON. I was wondering: This I do not believe needs to go on the record, but these things actually are the only copies I have, unfortunately.

Mr. RIEHLMAN. If we need them we can have photostatic copies made and return them.

Mr. BALWAN. They would be available for photostating?

Mr. EATON. Yes.

Mr. BALWAN. Suppose we leave it with the arrangement that we will return them.

Mr. RIEHLMAN. Yes.

(The information is herewith inserted.)

Mr. EATON. I might add further that one of the reasons that I was asked to go to the special devices center was to somewhat get the place back on the track and running somewhat in more of a business fashion. At least that is what Admiral Bolster inferred at the time.

By normal procedures it is necessary that performance ratings are filled out after you go to a job of this type after you have been there 3 months.

Mr. MCCORMACK. Will you speak a little louder, please?

Mr. EATON. Yes. After you have been there 3 months. I would like to read this first one.

The performance rating was satisfactory. It says:

> Mr. Eaton has been in his present position for only 3 months, however, he has taken hold of a confused state of affairs and is making excellent progress in cleaning up a chaotic situation. Without question, Mr. Eaton is doing an outstanding job by all normal standards.
>
> T. B. HALEY.

That was the captain.

Mr. IKARD. Was Captain Haley in command of the military?

Mr. EATON. Yes.

Mr. MCCORMACK. Where are you now, Mr. Eaton?

Mr. EATON. The special devices center.

Mr. BALWAN. In the same place.

Mr. MCCORMACK. All right. You said, "Taken hold of a confused state of affairs." When did you go to your present post of duty?

Mr. EATON. September 1951.

Mr. MCCORMACK. What was the situation you found there at the time?

Mr. EATON. Well, there had been practically no administration over the technical operation.

Mr. RIEHLMAN. Who was in charge of the technical operation before you went there?

Mr. EATON. A man by the name of Rhoades, I believe.

Mr. BALWAN. A civilian?

Mr. EATON. Yes. As I recall it he was a retired Bell Lab employee.

Mr. MCCORMACK. Was this confused state of affairs having an effect upon the research organization?

Mr. EATON. Well, it was pretty much having an effect on everything. It was the type of organization they had. While it was not very much different from the one I took over it was entirely a different operation than good business would dictate.

The next regular performance rating came in May of 1952. From there on they happen once a year. This is also signed by Captain Haley and said:

Mr. Eaton's performance of duty has been by all normal standards, outstanding. His quality of work has been superb. The broad comprehensive nature of the duties of the position makes the position a most difficult one to fill without a background of administrative and industrial experience. It includes more than the technical field of device development. It includes budgeting, financing, planning, logistics, maintenance, et cetera. In all of these the performance has been outstanding to the point of special mention.

His handling of special and unusual situations, his evaluation of trouble areas and prompt and effective measures for correction, his advice and guidance for subordinates, and his initiative and force, have contributed to the unusual quality of work performance.

On June 9, 1952, SDC, Special Devices Center Instruction 5400.2 was issued with the subject "Organization, policies, missions, and functions of Special Devices Center."

The one thing I would like to read here are two short sentences covering the relationship between the executive officer and the technical director.

As you will notice on the organization chart, that technical director by the chart answers directly to the executive officer and the commanding officer. This delineates the difference, in which it points out that the executive officer handles the housekeeping side of the operation in support of the technical side.

This is a partial listing of what the executive officer does:

He maintains a familiarity with the technical program of the center and follows its progress in sufficient detail to insure that administrative decisions are made which support the technical mission.

The operation of the technical director:

Assigned complete responsibility and authority for the administration, performance, and timely achievement of the center's technical mission. The technical director plans, directs, coordinates, and evaluates the center's technical divisions and technical staff, all research, development, production, installation and maintenance, service, contractual matters, and all associated technical activities carried out by the center in support of its research and development programs. He is technical adviser to the commanding officer and director and is the point of technical authority to the Chief of Naval Research in all fields of research and development carried on by the center.

Mr. BALWAN. What status does this document have? Is it in the form of a charter between the Office of Naval Research and your center, or what is it?

Mr. EATON. This is normally a statement based on the missions and functions of how we are expected to operate and what are the duties of the individuals.

Mr. BALWAN. Who drafts this?

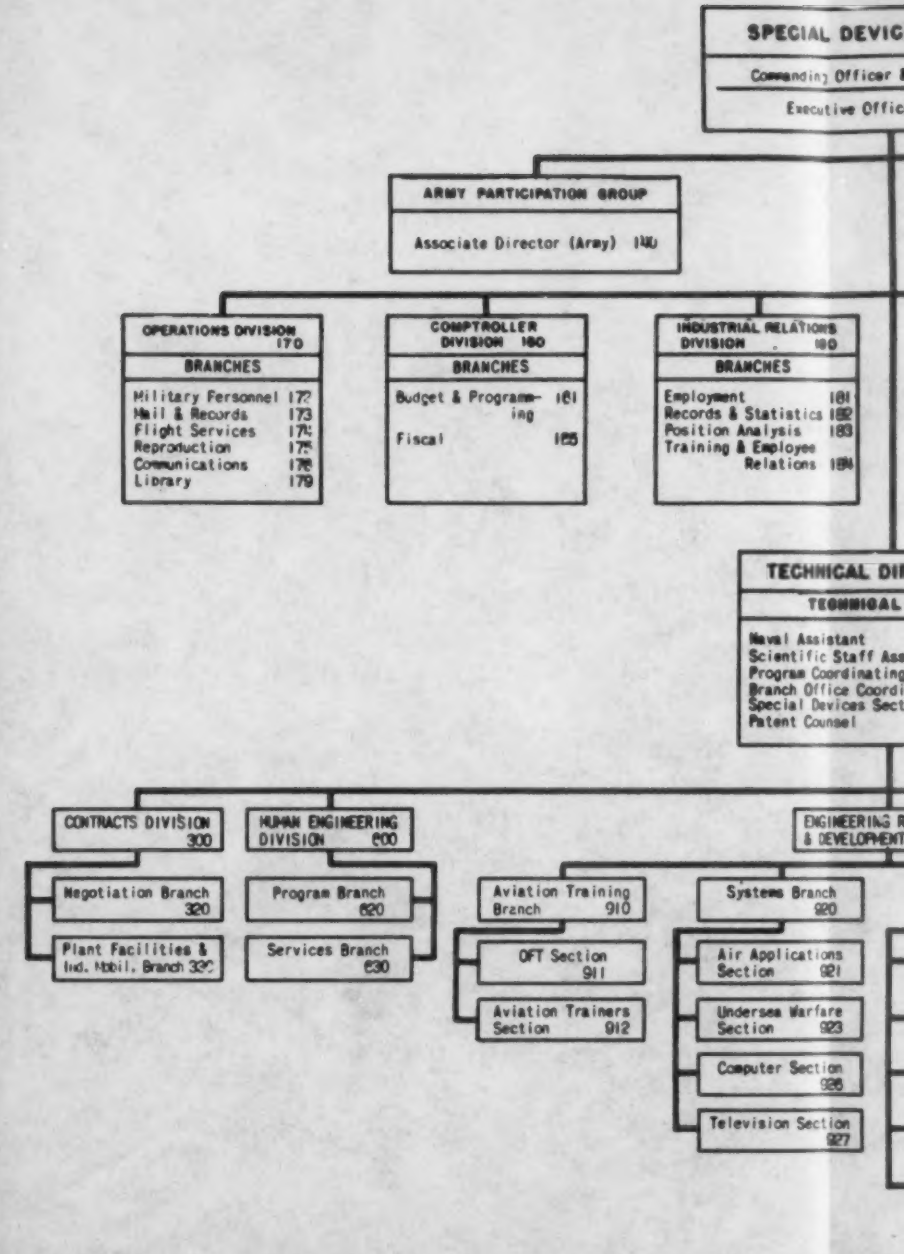
Mr. EATON. This normally is a combination draft made up for the commanding officer's signature, of which he normally gets informal approval by the Chief of Naval Research.

Mr. BALWAN. Why do you say "informal approval"?

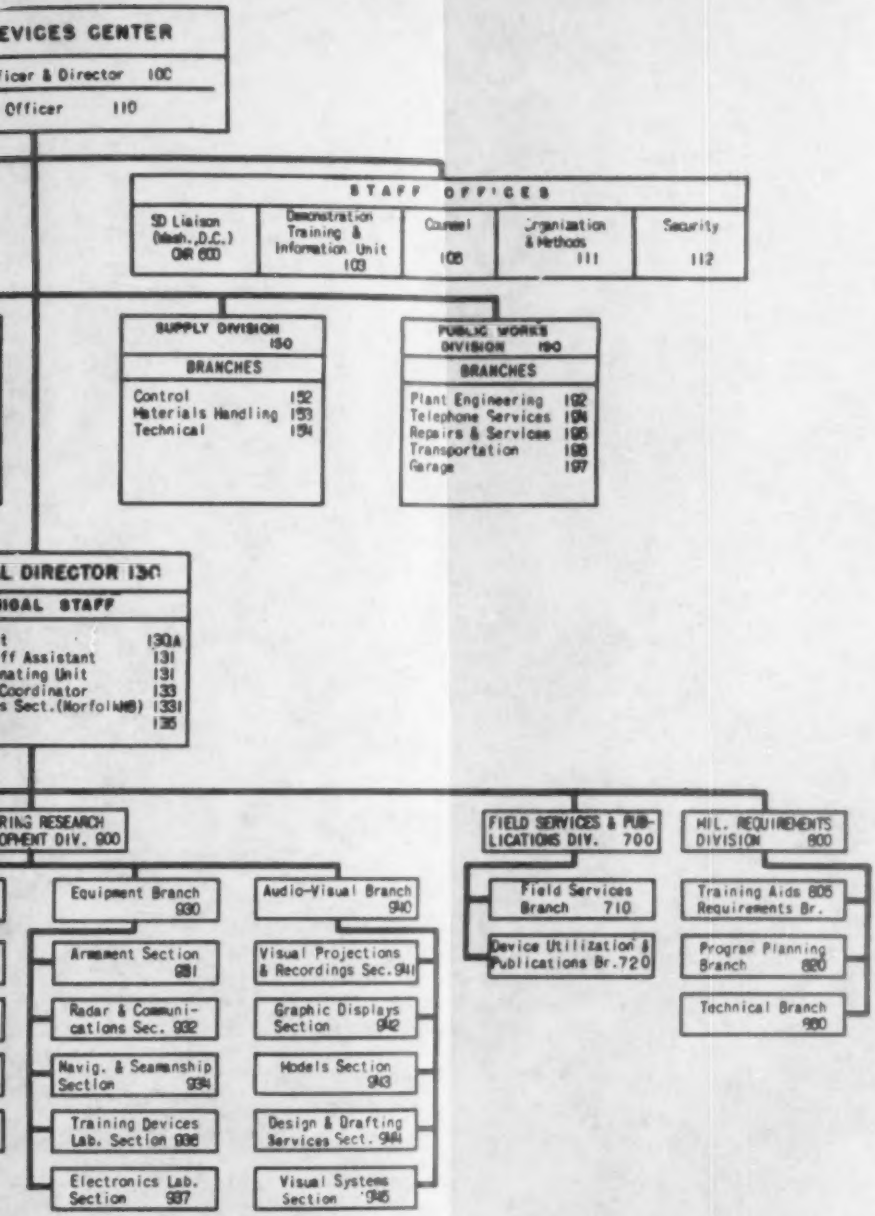
Mr. EATON. Well, there is no requirement that this has to have his formal signature or anything on it. Copies of this, however, do go to the Chief of Naval Research once they are issued.

Mr. MCCORMACK. But it has the effect of formal approval?

Mr. EATON. Right.



DATE	APPROVED BY	TITLE OF PARENT ORGANIZATION
18 JUNE 1952	T. B. HALEY COMMANDING OFF. & DIRECTOR	OFFICE OF NAVAL RE



	TITLE OF FIELD ACTIVITY	CHART NO.
. RESEARCH	SPECIAL DEVICES CENTER	F13C

Mr. McCORMACK. Is the technical adviser a civilian or an officer there?

Mr. EATON. The technical director?

Mr. McCORMACK. The technical director.

Mr. EATON. That is me. A civilian.

Mr. McCORMACK. Yes. It has to be a civilian. What about the administrative officer?

Mr. EATON. The administrative officer, as pointed out in here, is the executive officer.

Mr. McCORMACK. He is the what?

Mr. EATON. The executive officer.

Mr. McCORMACK. Yes.

Mr. BALWAN. Is he the military man there?

Mr. EATON. Yes.

Mr. BALWAN. What rank does he normally hold?

Mr. EATON. Commander.

Mr. BALWAN. What rank does the commanding officer hold?

Mr. EATON. Captain.

The commanding officer is normally an AEDO, which is aviation engineering duty only.

The executive officer has for some time been—and its billet, I believe, is established—a line officer submariner. The executive officer, of course, in any kind of organization of this type has to have administrative control over the military, and since in the organization I had approximately 30 military officers working for me that is one of the reasons it is shown in the top block with the commanding officer.

Carrying the date of June 16, 1952, another chart of the organization was published, F–13–C. This was to show some slight changes in the Engineering Research and Development Division, dictated by increased emphasis required on aviation training aids. Other than that there is no significant change.

I do not believe I need to enter into the record this other regular performance rating.

Mr. BALWAN. Why do you not go ahead and enter that in the record?

Mr. EATON. This was the last of the performance ratings by Captain Haley:

> Mr. Eaton's performance of duty has by all normal standards been uniformly outstanding. He has and is now contributing immeasurably to the improvement and betterment of the technical administration of the center's program. The quality and quantity of his work is superb. His broad technical knowledge and wide administrative and engineering experience form an excellent basis for sound and proper decisions.
>
> As a consequence, Mr. Eaton has demonstrated an unusual and exceptional aptitude for outstanding performance in every phase of his work. This is substantiated by the part he has played in the redesign of the course generator, device 15–J–4, by the strides which have been made in the field of definitive specifications, the timely submission of engineering documents, and the prestige he has established for the center by his broad technical guidance and direction.

That was signed by Captain Haley.

Mr. BALWAN. Are you satisfied during this period of a year and a half now that the center did have civilian control? You had wide latitude.

Mr. EATON. Right.

Mr. BALWAN. And you could operate in accordance with the conditions set up in the job description and the promises made to you in the way you could conduct the place?

Mr. EATON. Right. I had the complete backing of the command and practically no interference except really at my request.

Mr. MCCORMACK. Except what?

Mr. EATON. Except by my request to the executive officer.

Mr. BALWAN. This brings us up to April 1953.

Mr. EATON. Right.

Mr. RIEHLMAN. Under what circumstances would you request assistance from the commanding officer?

Mr. EATON. Well, I had more or less conferences. We would get together on practically all problems that would come up.

As far as the executive officer was concerned, I would always call him in whenever something came up relative to military administration or housekeeping, where we needed help, and things of that nature.

Mr. RIEHLMAN. That was only under his jurisdiction?

Mr. EATON. Correct.

The next occurred during July of 1953. The command was turned over from Capt. T. B. Haley to Capt. Harry Sosnoski.

Mr. MCCORMACK. How do you spell it?

Mr. EATON. S-o-s-n-o-s-k-i.

Mr. BALWAN. Mr. Eaton, is this about right for the length of tenure for the commanding officer; 2 years?

Mr. EATON. Yes. Being an AEDO billet, the commanding officer changes rather rigorously in 2-year periods. The reason for this, of course, being that there are a lot of AEDO officers and very few command positions such as this for them. Consequently, it is desirable to change it every two years from the Bureau of Aeronautics standpoint, so that everyone will have a chance at it.

Mr. BALWAN. This is a device by which they give officers a chance to have a command?

Mr. EATON. Right.

Mr. BALWAN. And they do not have enough commands to go around, so they have to rotate their men frequently?

Mr. EATON. I would say they have too many AEDO's for the number of commands. I think it is better put that way.

Mr. BALWAN. Too many top officers?

Mr. EATON. Right. It so happened that at this particular turnover point all the top officers had rotated within 12 months. This includes 5 commanders that worked for me, the executive officer, and the commanding officer.

Mr. BALWAN. All within a period of 2 years?

Mr. EATON. All within a period of 12 months.

Mr. BALWAN. Twelve months.

Mr. EATON. They had rotated or changed.

Mr. MCCORMACK. New officers were assigned?

Mr. EATON. Right.

Mr. MCCORMACK. What effect does that have on the work or production or stability or training and education and so forth?

Mr. EATON. That is one of the big problems.

Mr. MCCORMACK. Does it have a tendency to hold back in the research work?

Mr. EATON. Yes, it does, for this reason: That you never know how far a project that may be under their direct or indirect influence may be along when they will leave and some new officer will come in then and start putting his particular tastes into this influencing the device. It definitely has an instability as far as the whole organization is concerned.

At the time of this turnover I called it to Admiral Bolster's attention, and he was very surprised. He didn't realize what had happened and said he would certainly try and do something about it, because normally if you have this rotation and more or less interweave it in such a manner that the captain overlaps the new executive officer, say, for a year and some of the other officers overlap by a year other officers, it is much easier to keep a somewhat stable organization; but still in this kind of operation I don't think anyone gets really very well acquainted with it and is really very productive, say, more than 6 months.

Mr. BALWAN. Could you make an analogy of the situation with what might occur in business?

Mr. EATON. Well, I would say that the only thing I can compare it to in business is changing the general manager every 2 years from the outside and not within.

I had plenty of experience with attrition in general managers and chief engineers while I was with Curtiss, but a lot of that was filled within, and even that was bad, but that still is not comparable to a situation here which I consider to be the same if you were changing in industry every 2 years, general managers or chief engineers.

Mr. MCCORMACK. General manager what?

Mr. EATON. If you changed every 2 years a general manager from outside, just went out and brought in a new general manager, and then 2 years later got rid of him and brought in another one.

I mean that would be my analogy to this kind of situation.

Mr. MCCORMACK. That doesn't happen in private business; does it?

Mr. EATON. No.

Mr. RIEHLMAN. Are you prepared to give the Committee some information as to what happened in respect to your program after this change of command?

Mr. EATON. Well, I can merely show you what started after this happened.

Mr. RIEHLMAN. May I ask this question: Prior to that, prior to your answer, these men that were rotated into these positions that you referred to, do you have any knowledge of their background and experience in this field?

Mr. EATON. We normally have some advance notice of what their background has been; but in order to get officers that have training background, it is very seldom that you get them because this is actually a fairly new sort of business, this training business, and there are not very many officers, and if you get one that has had previous training experience, it is unusual.

That situation, of course, as time goes on, will improve; but at present it is too much of a new game, as far as I would say, to have good officers in with lots of training experience.

Mr. MCCORMACK. What about the commanding officer? Do you have a man with previous experience?

Mr. EATON. Not particularly in training. He has had some, but not an awful lot.

Mr. MCCORMACK. Would he have experience in engineering?

Mr. EATON. Well, he is an engineering aviation-duty-only officer. So, he has had an engineering degree as well as an Annapolis degree.

Mr. BALWAN. What kind of experience would this particular commanding officer have? Do you know anything about his background?

Mr. EATON. I know very little about it, except I believe he came from a tour of duty in the Bureau of Aeronautics, and I am not certain as to what desk he held down there. Previous to that he spent 2 years in London, I believe, attached to the naval attaché's office, and I am a little hazy about that. I believe he may have been taking schooling previous to this post graduate work, but I'm not too certain on his background.

Mr. BALWAN. How about the executive officer, the military man?

Mr. EATON. The executive officer, as far as I know, being a straight-line officer, has had, I believe, very little shore duty, and I doubt if any in handling civilians.

Now, this is something I am not certain about.

He has a very excellent war record.

Mr. BALWAN. What kind of sea duty did he have?

Mr. EATON. Well, being a submariner, he has been confined pretty much to submarine duty.

Mr. BALWAN. A submarine officer?

Mr. EATON. Right.

Mr. MCCORMACK. How many officers do you have assigned?

Mr. EATON. I believe there were about 40, I think; between 40 and 45, I believe.

Mr. MCCORMACK. How many civilians?

Mr. EATON. We had a total of 538 civilians, of which in the technical group there were 322.

Mr. MCCORMACK. What do you mean by "technical group"?

Mr. EATON. Well, most of those are engineers, and their supporting personnel, like secretaries, and so forth.

Mr. BALWAN. How many military men do you have there?

Mr. EATON. A hundred and twenty-seven, of which, I would say, between or about 45 are officers and the rest enlisted men.

Mr. LIPSCOMB. Mr. Chairman.

Mr. RIEHLMAN. Yes, sir.

Mr. LIPSCOMB. Do those officers work in the technical division, in your division?

Mr. EATON. Yes, sir.

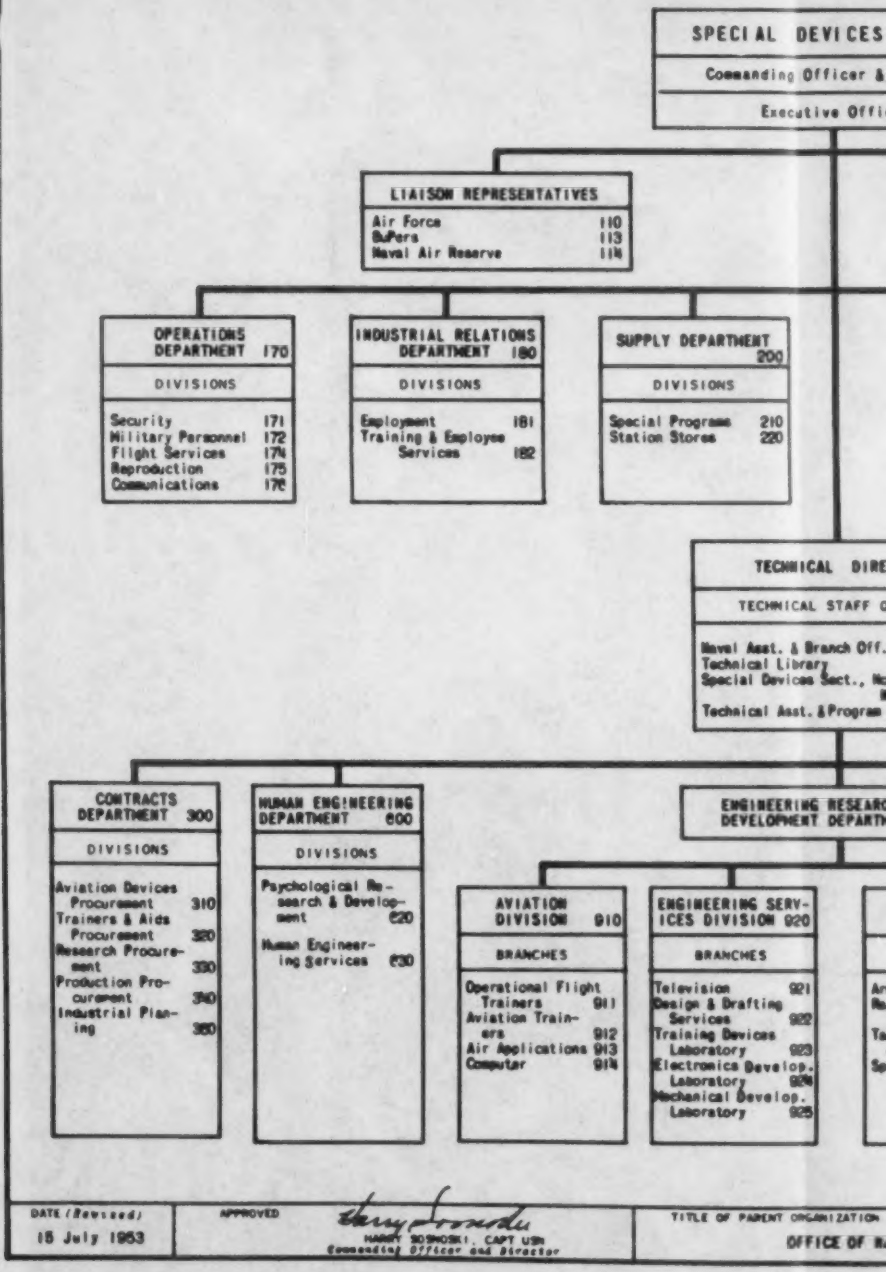
I had about at that time, and have much less now, because there have been some organization changes recently, approximately 30 officers working with me, 5 commanders.

Mr. MCCORMACK. Were they under you?

Mr. EATON. Yes.

Mr. MCCORMACK. Did they undertake to dictate to you?

Mr. EATON. No, because the commanding officer, as commander, Captain Haley, expected them to work as civilians as far as their job was concerned; and at times when I did have difficulty with one particular commander that was obstreperous I was instructed by him to say that if he was going to look at this question with a uniform on to consider that I had four stripes.


SPECIAL DEVICES
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Aviation Trainers 912
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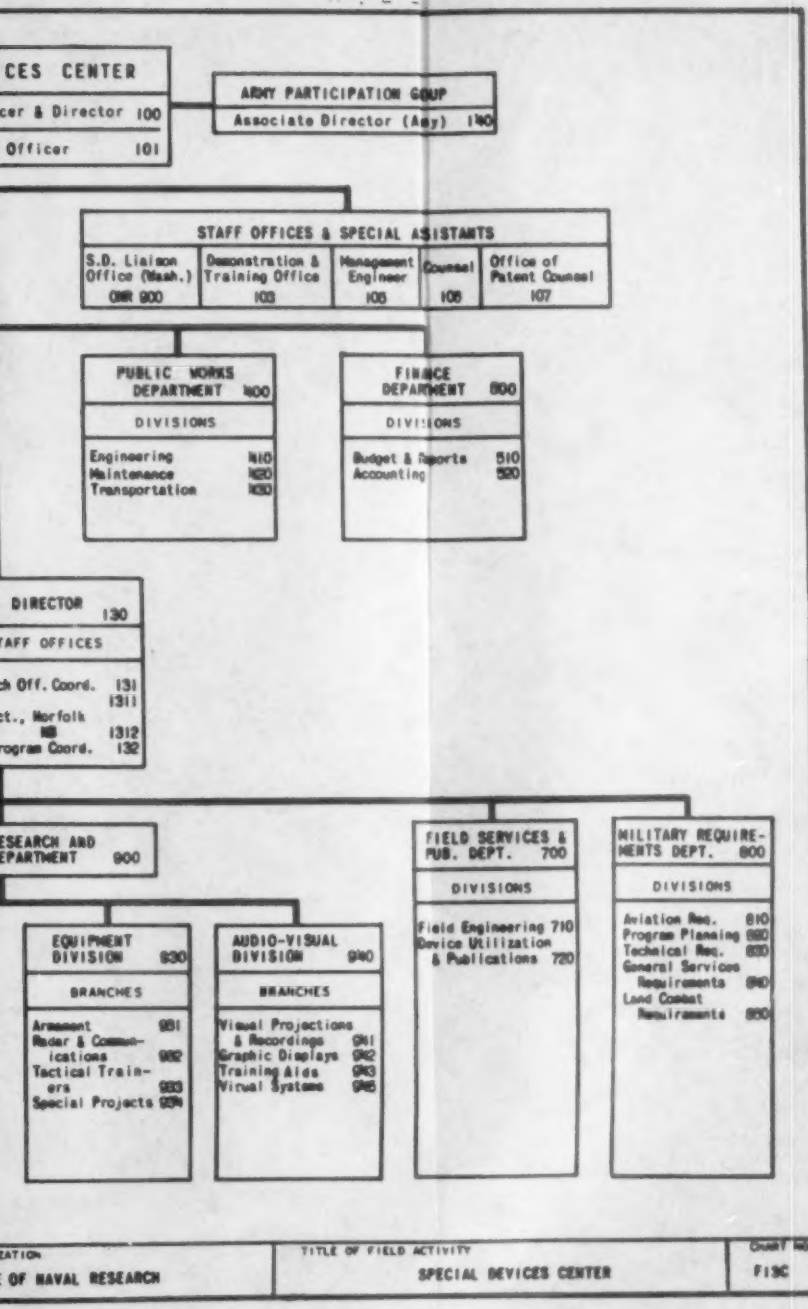
Computer 914
ENGINEERING SERVICES DIVISION 920
BRANCHES
Television 921
Design & Drafting Services 922
Training Devices Laboratory 923
Electronics Develop. Laboratory 924
Mechanical Develop. Laboratory 925
DATE (Revised)
15 July 1953
APPROVED
HARRY SOSNOSKI, CAPT USN
Commanding Officer and Director
TITLE OF PARENT ORGANIZATION
OFFICE OF N



ZATION	TITLE OF FIELD ACTIVITY	CHART NO.
E OF NAVAL RESEARCH	SPECIAL DEVICES CENTER	FI9C

Mr. McCORMACK. You had what?

Mr. EATON. Full support of Captain Haley.

Mr. LIPSCOMB. How does he work with the other people in your technical group, the other scientists? Does he direct them or supervise them?

Mr. EATON. Yes; some of the officers do, and some of the officers, of course, are under civilians.

The commanders in general, except in the case of the engineering, research and development department, were heading up particular divisions, departments, whatever you want to call them, but in the other case the GS–15 engineer was over that particular commander.

Mr. McCORMACK. How are the other members of the technical force getting along with the officers?

Mr. EATON. I would say in general at that time quite well.

Mr. McCORMACK. You say at that time?

Mr. EATON. Yes.

Mr. McCORMACK. Was there some kind of a breaking point?

Mr. EATON. Yes.

As this goes on, you will see where the division comes.

Mr. BALWAN. From this point on, Mr. McCormack, he explains how this relationship broke down.

Mr. EATON. On July 15, 1953—this was very shortly after Captain Sosnoski had taken over—another organization chart was issued, chart No. F–13C.

The only changes in this chart over the previous one was the fact there was a SECNAV instruction out that divisions should be raised to departments, and this merely reflects that the old divisions were changed to departments, and that is the extent of the change.

The next is September 1953, and I might add between approximately the 1st of June and this time in September we had been trying to work out a scheme whereby we could get limiting contracting authority at the center which we did not have. Our contracts department negotiated contracts, but our actual contracting officers were either NPO New York or the contracting officer of the Office of Naval Research in Washington.

The method by which I had planned to do this was to ask for limited contracting authority. In other words, between 75 and 80 percent of our contracts, paperwise, could have been handled had we had a hundred thousand dollar contracting authority limitation.

I discussed this with Admiral Bolster and he seemed to think it was perfectly all right. I explained I was going through the normal channels of their contracts department to arrive at this, realizing we would have to have one grade higher in the contracting department in order to justify this to the Office of Naval Research. It seemed logical for that and other technical reasons that the transfer of contracts department should be made from the technical side direct to the commanding officer; and a notice, Special Devices Center, 5400, dated September 17, 1953, signed by Captain Sosnoski, subject, "Transfer of the Contracts Department" made that an active move.

SPECDEVCEN NOTICE 5400

OFFICE OF NAVAL RESEARCH,
SPECIAL DEVICES CENTER,
Port Washington, N. Y., September 17, 1953.

From: Commanding officer and director.
To: Distribution list B.
Subject: Transfer of the Contracts Department.

1. *Purpose.*—This notice is issued to effect an organizational change.

2. *Contracts Department Transferred.*—Effective September 21, 1953, direct responsibility for the functions of the Contracts Department (Code 300) is transferred from the Technical Director to the Commanding Officer and Director.

(*a*) This change in organization will be incorporated in the next issue of the Center's official Organization Chart.

3. *Cancellation.*—This Notice is canceled when contents are noted and corrections made. For purposes of record, this Notice is canceled September 30, 1953.

HARRY SOSNOSKI.

Mr. BALWAN. What is the significance of that?

Mr. EATON. That is merely to show that this was an organization change, which was predicated on the fact we would get contracting authority; and I went along with it for that reason, but it is a change and the contracting authority, of course, never arrived.

Mr. BALWAN. I want to interrupt just a minute here.

When Captain Haley turned over the command to Captain Sosnoski, did you have any information as to whether Captain Haley wanted to stay on?

Mr. EATON. Yes. Captain Haley requested to stay on another year. This was coupled with the fact in my discussions with him I didn't like this complete changeover.

It was at that time that Admiral Bolster went to, I believe it was, Admiral Grant and requested Captain Haley stay on another year, but was refused on account of this——

Mr. RIEHLMAN. Policy?

Mr. EATON. Policy; yes.

Mr. BALWAN. What happened to Captain Haley? Did he get another command?

Mr. EATON. No. Captain Haley went with the Industrial Survey Board in the Pentagon, which is under the Bureau of——

What is it? Materiel?

Mr. BALWAN. Office of Naval Materiel?

Mr. EATON. Yes.

Mr. BALWAN. Will you proceed from that point?

Mr. EATON. Pardon.

Mr. BALWAN. Will you proceed from your contracting change here?

Mr. EATON. Yes.

During this time there was a definite indication that communications had been breaking down between the commanding officer and myself and that the executive officer was more and more getting into the technical side of the house. This was prevalent in bypassing, and I was attempting at the time also to get some new technical directives out to improve our operation; and two of these went into the captain's office and were not acted upon for about 6 weeks. As a matter of fact, they have never been acted upon.

Mr. MCCORMACK. Which captain?

Mr. EATON. Captain Sosnoski.

Mr. McCormack. What was your experience in the past with Captain Haley on matters of that kind?

Mr. Eaton. On matters of that kind we would discuss the thing and it would go out immediately, because these directives affected only the technical operation.

Mr. Riehlman. They had nothing to do with his own personal activities?

Mr. Eaton. No.

Mr. Riehlman. And his supervision of the program setup?

Mr. Eaton. Except as it should go through me.

Mr. Riehlman. Yes.

Mr. Balwan. With the changeover in contracts department was that directed by the commanding officer?

Mr. Eaton. Yes; that was directed by the commanding officer, after the deputy contracting officer, the Office of Naval Research, came up and spent some time going over the situation, and was also favorable to changing the contracts department, and he made that recommendation to the captain, and I concurred.

Mr. McCormack. Who was the deputy?

Mr. Eaton. Mr. Frank Reynolds in the Office of Naval Research.

Mr. McCormack. He is a civilian?

Mr. Eaton. Yes.

On the 6th of October, the Office of Industrial Relations in Washington requested all Public Law 313 jobs in the Navy be brought up to date.

Mr. Balwan. What about those 313 jobs? Are they the supergrades?

Mr. Eaton. That is right.

Mr. Riehlman. Supergrades, S–15, 16, 17, I think.

Mr. Eaton. They are by separate law. They fall in between. This particular salary group falls in between a 17 and 18.

Mr. Riehlman. Oh, I see.

Mr. Balwan. What are they?

Mr. Eaton. Public Law 313, 80th Congress—it carries no actual grade as such. The salary ranges just happen to be in between there.

Mr. Balwan. What was your salary?

Mr. Eaton. Thirteen thousand five.

On October 6, Captain Sosnoski signed the revised position description, which was worded the same as the one before, excepting as to the contracts department; and I would like to bring up next that particular project which was under consideration, which was from the Douglas Co. that came in around June of that year.

I cleared with Admiral Bolster in July that the project was, from a technical angle, impractical. Since we were already carrying on a more advanced research and development program in that area, we did not consider that it was worth the money involved.

Now, this particular consideration was requested by the Bureau of Aeronautics.

So, I prepared two letters, one turning the proposal down to the Douglas Co. and one with all the supporting data why I had turned it down, and sent this to the Office of Naval Research.

Since it was in the computer field and they have cognizance of overall, generalized computer development, I wanted to be sure to

be on record why we had turned this Douglas proposal down, since it involved some pressure from the Bureau of Aeronautics.

So, on the 27th of November 1953, I received an interoffice memo addressed to myself and the head of the Engineering Research and Development Department, subject Douglas Universal Computer Proposal:

It is the opinion of both Admiral Bolster and Captain Grimes that we should go through with the subject study for political purposes in keeping BuAer's goodwill.

Please take action to prepare the project justification for that study.

Captain SOSNOSKI.

(The memorandum referred to is as follows:)

OFFICE MEMORANDUM

NOVEMBER 27, 1953.

To: 130, 900.
From: 100.
Subject: Douglas Universal Computer Proposal.

1. It is the opinion of both Adm. Bolster and Capt. Grimes that we should go through with the subject study for political purposes in keeping BuAer's goodwill. Please take action to prepare the PJ for that study.

HARRY SOSNOSKI, *Captain, USN.*

(Penned addendum: "Adm. Bolster knew nothing of this in discussion with Capt. Sosnoski on 12–2–53.")

Mr. EATON. I subsequently found that Admiral Bolster had never beet cut in on this and knew nothing of it since the time I discussed it, when I told him I was going to turn it down.

Mr. BALWAN. What did you do about this directive you had?

Mr. EATON. I, naturally, followed it out.

Mr. BALWAN. Could we just reconstruct this thing, because it is very important?

Do you understand that, Mr. Riehlman?

Mr. RIEHLMAN. I think I do, but it would be well to reconstruct it.

Mr. EATON. This is in direct opposition to what my position description—under supervision and guidance on technical matters, I am supposed to be the final authority, and this was purely technical.

Mr. RIEHLMAN. Purely technical, and here is a military director directing your activities against your own best judgment?

Mr. EATON. After I had been on record for several months.

Mr. RIEHLMAN. Yes.

Mr. BALWAN. This involves, in other words, a proposal for a project which had been presented to you earlier in 1953?

Mr. EATON. Right.

Mr. BALWAN. Which you felt was not a wise proposal to undertake?

Mr. EATON. Yes.

Mr. BALWAN. So, you turned that down?

Mr. EATON. Yes.

Mr. BALWAN. Later on in October you get a memorandum from the commanding officer——

Mr. EATON. This is November.

Mr. BALWAN. November—directing you that, for the reasons stated on the memo, you are to go ahead and approve the project?

Mr. EATON. Yes.

Mr. BALWAN. Was it an important project?

Mr. EATON. Well, I didn't consider it so, since we already had a project paralleling or better. The techniques were superior and more advanced to this, and had been in the process with the University of Pennsylvania for about 3 years.

Mr. BALWAN. This was an example of how a military man can step in and tell a technical director what to do?

Mr. EATON. That is right.

Mr. BALWAN. If he wants to.

Mr. EATON. That is right.

Mr. COTTER. Was this a development project or a research project?

Mr. EATON. This was a study which would go into a development project.

Mr. COTTER. It was preliminary to the development project?

Mr. EATON. Right.

Mr. COTTER. Was it a fire-control computer?

Mr. EATON. No; this was what we call a universal computer for operational flight trainers. In other words, at present our operational flight trainers, which are very expensive, have individual computers that correspond to each type of aircraft. This particular computer was supposed to be more or less universal, so that instead of furnishing with an operational flight trainer a computer for each one you would merely furnish the cockpit and reprogram the material in the computer that would fit the new aircraft, and would save roughly 35 percent of the cost of the operational flight trainers.

Mr. BALWAN. You could not object to this order, naturally?

Mr. EATON. No. The only thing, since I had been on record, I would not sign any of the official paperwork.

Mr. LIPSCOMB. Mr. Chairman.

Mr. RIEHLMAN. Yes, sir.

Mr. LIPSCOMB. The directive wasn't based on any technical reason at all, though, was it?

Mr. EATON. No; it was merely for political reasons.

Mr. RIEHLMAN. What he said there was to keep in the good graces with BuAir.

Mr. EATON. Bureau of Aeronautics.

Mr. RIEHLMAN. And keep those boys happy, apparently.

Mr. BALWAN. Who wanted to keep in good graces with them? The commanding officer wanted to keep in good graces with the Bureau of Aeronautics?

Mr. EATON. That is what he has told me.

Mr. RIEHLMAN. That is certainly what you could interpret from what the statement is.

Mr. EATON. As I have mentioned, the general tenor of communications breaking down, and what not—there is a civilian sheet that is put out periodically called the Centergram, and I would like to read here from the Captain's Corner, his message to the people on communications. He goes in, of course, to state the communications are important and all that, but this is the paragraph on what he considers good communications, apparently:

> Verbal orders passed down through several organizational levels are sometimes misconstrued. At our center there have been uneasy moments experienced by persons who believe that they would be adversely affected by what they interpreted the word to mean. Again, the word often is not passed to all persons who should know.

I and others more or less at the top of the heap will at times bypass 2 or 3 echelons of management to assure that we get through directly to the man who has to do the job. On the other hand, it happens that in order to get the job done someone down the line picks up the ball on his own or makes a commitment for his component without cutting in his boss.

It is essential that the person on whose authority the commitment was made be kept informed. When an echelon or two has been bypassed in relaying the word, either up or down, it is the responsibility of the lower echelon to see that his or her superior is cut in.

I merely submit that because I consider it doesn't even fit the Navy practices in communication and certainly is not good industrial practice.

Mr. BALWAN. What is the net effect of that statement? Could you just state it?

Mr. EATON. What?

Mr. BALWAN. Could you state that in your own words?

Mr. EATON. This is merely bypassing echelons of normal authority in command or operation.

Mr. RIEHLMAN. I am just wondering: This is a circular that is put out to the employees; is that correct?

Mr. EATON. That is correct.

Mr. RIEHLMAN. What would be the commanding officer's purpose in putting out that circular?

Mr. EATON. That I don't know, except he wanted to stress the importance in the first paragraph of why he should have communications, and good communications. This is one of the methods apparently of getting it.

In January of 1954 a Special Devices Center Notice 5420–1, dated January 8, 1954, subject "Standing Committee for Review of Center Operations; Establishment of"—I bring this in merely to point out that a standing committee, which had been rumored before and which the captain had told me he was thinking about setting up or would set up probably to act on all matters that he would submit to them in the form of the various operations of the center. This type of committee, of course, can be argued considerably, I believe, but it happens the committee was at rather low working level, accomplishing very little and spent a lot of time.

I merely bring that up as another form of control, which I was not really cut in and asked for any comments on, and yet they were supposed to handle all forms of the operation of the center that the commanding officer gave to them to consider.

Mr. MORRIS. Would that include possibly technical questions?

Mr. EATON. Yes; it would include anything that he wanted to decide.

During this particular time there was a special group set up in Washington that consisted of members of BuShips, BuSandA, ONM, BuOrd, to review the missions and functions of the Special Devices Center. The reason for doing this was in the original act of setting up the Office for Naval Research the direct duties and the functions of the Special Devices Center were not spelled out properly. As a result, there was a lot of questioning and considerable sniping by the other bureaus, who have also been doing some training device development work; as to whether they should be in the production-procurement of devices; and, secondly, whether we should supply our own spare parts in our maintenance, in our installation and maintenance pro-

gram, or whether we should use exclusively the existing-supply activities, such as the aviation-supply system and what BuShips have.

These meetings went on for some time, and they came up with an agreement between all the bureaus, which was to fill in and be a SecNav order.

I bring this point up because the commanding officer, once this was accomplished, made a much greater point out of the fact that we, as I term a field activity of the Office of Naval Research, were a de facto bureau, and therefore, should be organized as a material bureau, he being from the Bureau of Aeronautics, would consider that was the probable goal.

The next action of any consequence occurred on the 8th of March 1954, when I was shown a rough draft of an order to be issued with the captain's initial on the top of it, which made the executive officer also a deputy director.

This, obviously, meant that it was pushing the technical director down one echelon and would put him in direct command over me for the technical direction.

I informed him at that time since that was in complete opposition to my position description that I would have to push it to Washington.

My first step in doing this was a personal letter to Dr. Piore, who is deputy and chief scientist of the Office of Naval Research.

I believe the first paragraph of this explains the position that I had taken on the matter. This is dated March 8, 1954:

DEAR MANNY: This is somewhat of an SOS. I had planned to discuss with you at our next meeting trends at the center I consider unfavorable. However, today produced a memo requiring more immediate action.

The executive officer showed me a rough draft of an order initialed by the captain, setting up the executive officer as deputy director and executive officer. This, of course, means that the technical director drops one echelon and comes under a line officer commander.

This is opposite to the ONR policy ground rules as given me by Admiral Bolster when I came to the center and followed by Captain Haley. The admiral used your position as ONR Deputy as an example of civilian control at the top echelon and made a specific point of this difference with the internal operation of the Bureau of Aeronautics.

This policy does not conform to my job description or the expressed views of Secretary Quarles on the subject.

This memo was consummated, I think between the captain and the executive officer without my knowledge.

I now have officers in all key positions in the technical operations.

The executive officer is very militarily minded and is getting support from the captain, who seems to be following Bureau of Aeronautics operating policy, which is, of course, military control several echelons down.

Frankly, with the captain away from the center, upwards of 50 percent of the regular working days, it has been extremely sticky trying to do my job for the past 6 or 8 months.

That is all that is really important.

I merely stated here I was going to push it up, have a conference with Captain Grimes and the Chief of Naval Research.

Mr. BALWAN. You made reference to Secretary Quarles in that. Could you explain what you mean?

Mr. EATON. Yes.

At the senior scientist meeting, the one annual one when everybody gets together from both coasts, at which Secretary Smith and Secretary Quarles attended. At that time Secretary Quarles stated that he considered the Navy laboratories had done a better job than the other services because, in general, their technical programs were operated by civilians.

Mr. BALWAN. On what date was that conference held?

Mr. EATON. You will have to help me on that, Ralph.

Dr. BENNETT. My guess is it was about the middle of September.

Mr. EATON. I thought it was in November. [Actual date, October 1953.]

Dr. BENNETT. It might be. We can get the exact date.

Mr. EATON. Yes.

Mr. BALWAN. Do you have a transcript or a copy of the address given by Secretary Quarles?

Mr. EATON. It was a transcript of his talk.

Mr. BALWAN. Have you a copy of that?

Mr. EATON. I don't have it with me, but I have a copy.

Mr. BALWAN. Can you provide us with a copy of that?

Mr. EATON. I think so. I will certainly try, anyway; and if not, somebody can. I am sure of that.

Mr. BALWAN. Thank you.

You also made reference in your letter to the commanding officer being away 50 percent of the time. Could you elaborate on that?

Mr. EATON. Well, he travels around considerably on business, and I couldn't really elaborate on that intelligently because it is at various training commands and conferences.

Mr. BALWAN. Has he been on duty?

How much time has he spent on duty, in the past 4 months?

Mr. EATON. Well, 4 months is rather a bad time probably to judge.

Mr. BALWAN. Well, how much would you judge in the past 4 months, say?

Mr. EATON. I wouldn't have any idea because he made this trip for 1 full month to Europe. That was on business.

So, the last 4 months would be a rather bad time, but I would say the average, since he has been there, would be not much over 50 percent.

Mr. BALWAN. So far as you know, this is official duties?

Mr. EATON. Right.

Mr. BALWAN. That he performs?

Mr. EATON. Right.

On the 11th of March 1954, special device notice 5400 was issued. This is the notice which I referred to in which the executive officer was made also a deputy director.

SPECDEVCEN 5400
100

SPECDEVCEN NOTICE 5400

OFFICE OF NAVAL RESEARCH,
SPECIAL SERVICES CENTER,
Port Washington, N. Y., March 11, 1954.

From: Commanding Officer and Director.
To: Distribution List B.
Subject: SpecDevCen Instruction 5400.2, Organization Policies, Mission and Functions of the Special Devices Center, of June 9, 1952, CH 1.

1. *Purpose.*—This notice promulgates a change to subject instruction.

2. *Action required.*—On page 2, paragraph A2 of enclosure (3) to subject instruction, cutout and paste over the following revised statement of functions assigned to the executive officer and deputy director:

COMMAND AND MANAGEMENT DIRECTION ▶

LIAISON ▶

STAFF FUNCTIONS ▶

LINE DIRECTION ▶

OPERATIONS ▶

LIAISON OFFICERS
AIR FORCE
BUPERS
NAVAIRES

SPECIAL DEVICES CENTER
COMMAND
COMMANDING OFFICER & DIRECTOR
EXECUTIVE OFFICER-TECHNICAL DIRECTOR

ARMY PA... GRO...

FIELD LIAISON OFFICER
NAVBUPERS
Chicago
San Francisco
Memphis
NAVAIRES Staff Army Navy Navy

MILITARY TRAINING REQUIREMENTS DEPT
Functions
Determination of requirements and training problems
Sponsorship
Project priorities and program position
R&D/procurement requirements
Long-range characteristics
Production requirements
Specifying service assistance

COMPTROLLER DEPARTMENT
Functions
Budget
Fund Programming
Reports & Statistics
Accounting
Payroll & Timekeeping

COMMAND SERVICES DEPARTMENT
Department Head

ADMINISTRATIVE SERVICES DIVISION
COMMUNICATIONS BRANCH
Mail
Messenger
Central Files
Telephone Services
Teletype & Radio
Registered Pubs
REPRODUCTION BRANCH
TRAVEL BRANCH
Navy Flight Services
Orders & Claims

SECURITY DIVISION

INDUSTRIAL RELATIONS DIVISION

MILITARY PERSONNEL DIVISION

SUPPLY DIVISION

PUBLIC WORKS DIVISION

ENGINEERING RESEARCH AND DEVELOPMENT DEPARTMENT
Director of Research and Development
Deputy Director

DEVICE ENGINEERING, RESEARCH & DEVELOPMENT DIVISION
Functions
Research
Design
Development
Test
Evaluation
Modifications
Production engineering

HUMAN ENGINEERING RESEARCH-OPERATIONS DIVISION
Functions
Device design applications
Supporting research
Consulting services

FIELD ENGINEERING DIVISION
Functions
Installation
Maintenance
Servicing
Operational training
Training standards & training devices
Technical publications; modernization
Modifications
Feedback

LABORATORIES AND FACILITIES DIVISION
Functions
Design & drafting
Planning & layout
engineering records
Experimental & Fabrication laboratory
Electronics Laboratory
Experimental & Development Laboratory

RESEARCH UNIT

ARMY PARTICIPATION GROUP

COMPTROLLER DEPARTMENT

Functions

Budget
Fund Programming
Reports & Statistics
Accounting
Payroll & Timekeeping

STAFF ASSISTANTS

DIRSP Liaison Officer
Counsel
Patent Counsel
Tech. Info Officer
Management Engineer

TECHNICAL STAFF

DEVICE UTILIZATION AND MATERIAL SUPPORT DEPT

Department Head

SUPPLY SUPPORT DIVISION

Inventory & Supply Management:
Stockage & Control Reports
Distribution, Storage & Issue
Stock Evaluation
Provisioning
Cataloging
Automation
Packing

ENGINEERING SERVICES AND LABORATORIES DIVISION

Design & Drafting
Drawings, Layout
Engineering Records
Experimental & Modification Fabrication
Electronics Laboratory
Environmental & Development Laboratory

CONTRACTS DIVISION

Negotiation
Administration
Industrial Plant Survey

DEVICE UTILIZATION DIVISION

FIELD ASSISTANCE BRANCH:
Training Aids & Devices & Use
Curricula & Syllabi Analysis
Training Techniques & Systems
Device Effectiveness Appraisals
Determination of Requirements

UTILIZATION MATERIALS BRANCH:
Development device utilization
Publications, Aids, Manuals, etc
Writes other technical device utilization materials

PUBLICATIONS PRODUCTION BRANCH:
Edits & rewrites device publications
Coordinates manuscript reviews
Obtains necessary artwork, photos, drawings, etc
Production
Printing arrangements
Readers and distribution control

TRAINING BRANCH:
TRADEVARA training & assignment
Factory training
Reserve Officer training

[CUT OUT AND PASTE OVER]

2. *Executive officer and deputy director.*—Direct representative of the commanding officer and director responsible for executing details of command, guiding, coordinating, and controlling the administration of the center. He is primarily responsible, in accordance with Navy Regulations, 1948, (art. 0801) for the organization, performance of duty, good order, and maintenance of high order of discipline of the entire command. He is responsible for developing and maintaining efficiency and economy in the business management of the center. He is required to be conversant with the technical program of the center. He is required to coordinate all activities of the command and make recommendations to the commanding officer and director on administrative, operational and technical matters. In the absence of the commanding officer and director, he assumes his responsibilities and acts for him. CH 1 3/10/54.

3. *Cancellation.*—This notice is cancelled when the change required has been entered.

W. C. HALL, Jr., *Acting.*

Now, there is one significant sentence here, I believe, that summarizes it, but I would like to read the corresponding sentence in the old one again, that is, as to the executive officer in the old notice:

He maintains a familiarity with the technical program of the center and follows its progress in sufficient detail to insure that administrative decisions are made which support the technical mission.

This corresponding sentence:

He is required to coordinate all activities of the command and make recommendations to the commanding officer and director on the administrative, operational, and technical matters.

Mr. BALWAN. That puts him in charge of the technical operation of the center?

Mr. EATON. Right, and being deputy director also adds to that.

Mr. BALWAN. So, on March 11, by this notice No. 5400, he took over?

Mr. EATON. Right.

On the 18th of March I went to ONR and discussed the matter with Dr. Piore, which was just a further discussion of the personal letter I had written him, and he was going to arrange a meeting with Admiral Furth, the Chief of Naval Research.

On the 19th of March the captain informed me that the admiral wanted to talk to himself, the executive officer, and myself about organization and missions, and so forth, and that he had arranged a meeting for the 26th at 10 in the morning.

On the 25th of March, at 4 o'clock in the afternoon, I was——

Mr. BALWAN. This was the day before he was to go to Washington?

Mr. EATON. That is right.

Mr. BALWAN. Is that right?

Mr. EATON. The day before.

I was shown a new organization chart, which I was not consulted about, and which had no technical director.

This chart was taken down on the 26th, and we had a meeting with Admiral Furth, Captain Grimes, Captain Sosnoski, Commander Hall, and myself.

At that time the admiral wished SDC to look further into the missions and functions and be sure that the functions corresponded to the

blocks on these charts and that there were no discrepancies. So that more or less stalled any direct approval which the captain was trying to get from the admiral of this rough organizational chart.

On the 29th of March 1954, a meeting of the standing committee, of which I read an order on, was called by the executive officer, at which time he informed them that there were no plans for a technical director in the future.

On the 30th of March 1954 the commanding officer went to ONR for their biweekly meeting, ONR's biweekly meeting, and had further talks with the admiral on the subject of the organization.

The commanding officer reported on this the next day at his biweekly meeting.

There is really nothing in here on the organization exactly as such, and it is a little bit too long, I believe, and it is somewhat irrelevant, except that the admiral is very pleased with the analysis that had been run on the general functions and missions as related to the center.

This particular report was made on the 31st of March in the morning.

In the afternoon I was called in to the commanding officer's office and he said that in discussing the organization he had discussed the Public Law 313 position with Admiral Furth and that the Chief of Naval Research had agreed with him that special devices center was too small to support the Public Law 313 job and that the admiral considered that a GS–14 was probably as high as could be justified according to that chart.

I immediately told the captain I would prepare papers for my resignation.

On this same date a memo, special devices center notice 5400, dated 31 March 1954—subject, "Organization of the special devices center, rexamination of"—was issued.

The action required on this was to have all departments' office heads produce comments on the particular chart that had been shown to Admiral Furth before. This, of course, is somewhat time consuming, as we had charts around there like flies for at least a week or so.

Mr. BALWAN. I want to interrupt you just a moment here.

Mr. Riehlman, what happened is that in March, March 8, 1954, Mr. Eaton was shown a rough draft of a chart, which established the executive officer as a deputy director and executive officer. This chart had the commanding officer's signature on it.

As I understand it, Mr. Eaton was not consulted.

Mr. EATON. Right.

Mr. BALWAN. Now, this didn't do anything to your position. They were just making the executive officer the deputy director in addition, and he read some references to show the difference between the job description for the executive officer when he first got there and the new job description for the executive officer.

On the 25th of March Mr. Eaton was called in to comment upon the organization chart, which eliminated the office of the technical director entirely. That was on the day before Mr. Eaton and the commanding officer were to come to Washington to the Office of Naval Research to discuss organizational problems.

Mr. RIEHLMAN. Let me ask you, to get this clear and on the record: Prior to that no one had discussed this change with you; is that correct?

Mr. EATON. No, except in very general terms.

As I mentioned, the commanding officer emphasized it was a de facto bureau operation. It should be operated like a material bureau and not as a laboratory.

Mr. RIEHLMAN. Now, how long had that laboratory been carried on, its activities carried on, the same as you had been carrying them on, or since you were director there?

Mr. EATON. I am not too familiar with actual dates on that. I believe it moved from Washington to Sands Point in—I believe it was—1946.

Mr. RIEHLMAN. It had at least been operating for 6 or 7 or 8 years?

Mr. EATON. Oh, at least that long.

Mr. RIEHLMAN. Yes.

Mr. BALWAN. With the same mission?

Mr. RIEHLMAN. The same mission?

Mr. EATON. Yes.

Mr. BALWAN. And on the 31st of March, the commanding officer called Mr. Eaton in to discuss this Public Law 313 job, saying he felt it was no longer necessary, and that brings us up to date here.

Then you mentioned your letter of resignation.

Mr. EATON. Yes.

Mr. BALWAN. When you refer to that letter of resignation, could you read that to the committee?

Mr. EATON. Yes. It reads:

From: Bruce G. Eaton, Jr., Technical Director, Special Devices Center.
To: Secretary of the Navy, via:
1. Commanding Officer and Director, Special Devices Center.
2. Chief of Naval Research.
3. Chief of Industrial Relations.
Subject: Position of Technical Director, Public Law 313, 80th Congress, resignation from and recommended disestablishment of.

1. The writer hereby submits and requests acceptance of his resignation from the subject position on or about July 1, 1954. The effective date of the writer's appointment to this position was September 16, 1951.

2. Accomplished and contemplated organizational changes by the commanding officer and director, Special Devices Center, redistributes the duties and responsibilities in the position description of the billet (SD–1991, dated October 6, 1953). Therefore, continuation after July 1, 1954, cannot be justified. It is recommended that the subject position be abolished coincident with the resignation of the writer.

3. It is also requested that copies of the endorsements to this letter be furnished the writer.

The first endorsement, signed by Captain Sosnoski, dated April 2, reads: "Forwarded recommended approval."

Mr. BALWAN. Why did you resign the position?

Mr. EATON. Well——

Mr. BALWAN. You figured the military had control, anyway?

Mr. EATON. Yes; that it was a waste of time, waste of money, rather, to keep extending the job when the military were moving in.

The second endorsement, dated April 14, signed by Admiral Furth—the first paragraph:

Forwarded, recommending with regret that the resignation of Mr. Eaton be approved.

The second paragraph:

The Chief of Naval Research considers that the question of disestablishment of the Public Law 313 position at the Special Devices Center is not germane to the basic request. If and when any organizational changes indicate that this

position is no longer justified, the matter will be made the subject of separate correspondence.

Mr. BALWAN. That indicates there was nonconcurrence in your recommendation.

Mr. EATON. That is hard to tell, for this reason: As of April 1, which was the day before my letter was written, Special Devices Center Notice 5400, dated April 1, 1954, subject: Military Requirements Department, Transfer of and Establishment as a Staff Organization of the Title of Training Requirements Department—so, that is another department that has been changed in accordance with this concept prior to any approval of this in Washington, and where the discrepancies in these things lie, I don't know.

Also, dated that same date, but delivered some time later, is an interim organization chart. Admiral Furth mentioned in a meeting with him down there that he thought there were too many departments answering to the captain.

Of course, this business of divisions and departments and so forth, I think is highly debatable, but this interim organization chart carries three more boxes answering to the captain than the last one.

So, I don't know whether it has progressed too much.

The minutes of the captain's meeting on the 15th of April, topic, Organization:

> Captain Sosnoski mentioned that comments from various department heads had been submitted and the standing committee has submitted its recommendations both from a majority as well as a minority standpoint.
>
> At the moment these recommendations are being put into an approximation for submission to the admiral for comment.
>
> The results of this will probably not go into effect until around July 1.

That was the actual submission of all the departments' heads and their comments, and from that the captain, I suppose, and the executive officer—I was not in on any of this—came up with a functional chart, which is dated April 19, which was submitted to the admiral for study.

The captain then left for Europe, and at the next biweekly ONR meeting that was attended by the executive officer—he came back and reported to me, personally—everything had come to a grinding halt until the captain came back, and this is what he reported to the other group:

> Commander Hall mentioned the regrouping of functions now under study by ONR and that it will be a slow process because it must be pursued very carefully to make certain the final result is the best.
>
> It is possible the target date of July 1 might be changed to one further in the future.

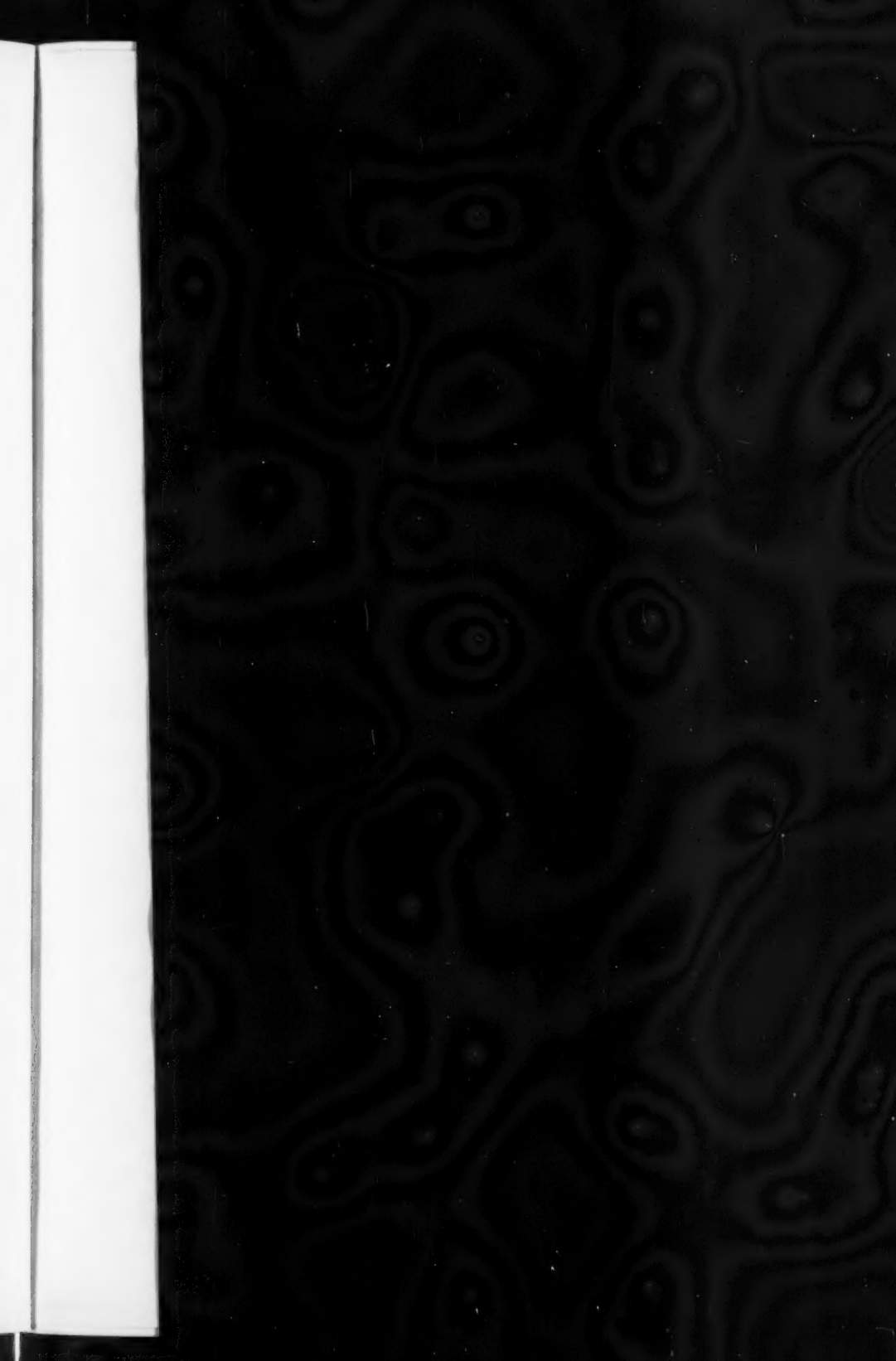
Mr. BALWAN. So, you don't know what the organization is going to do there.

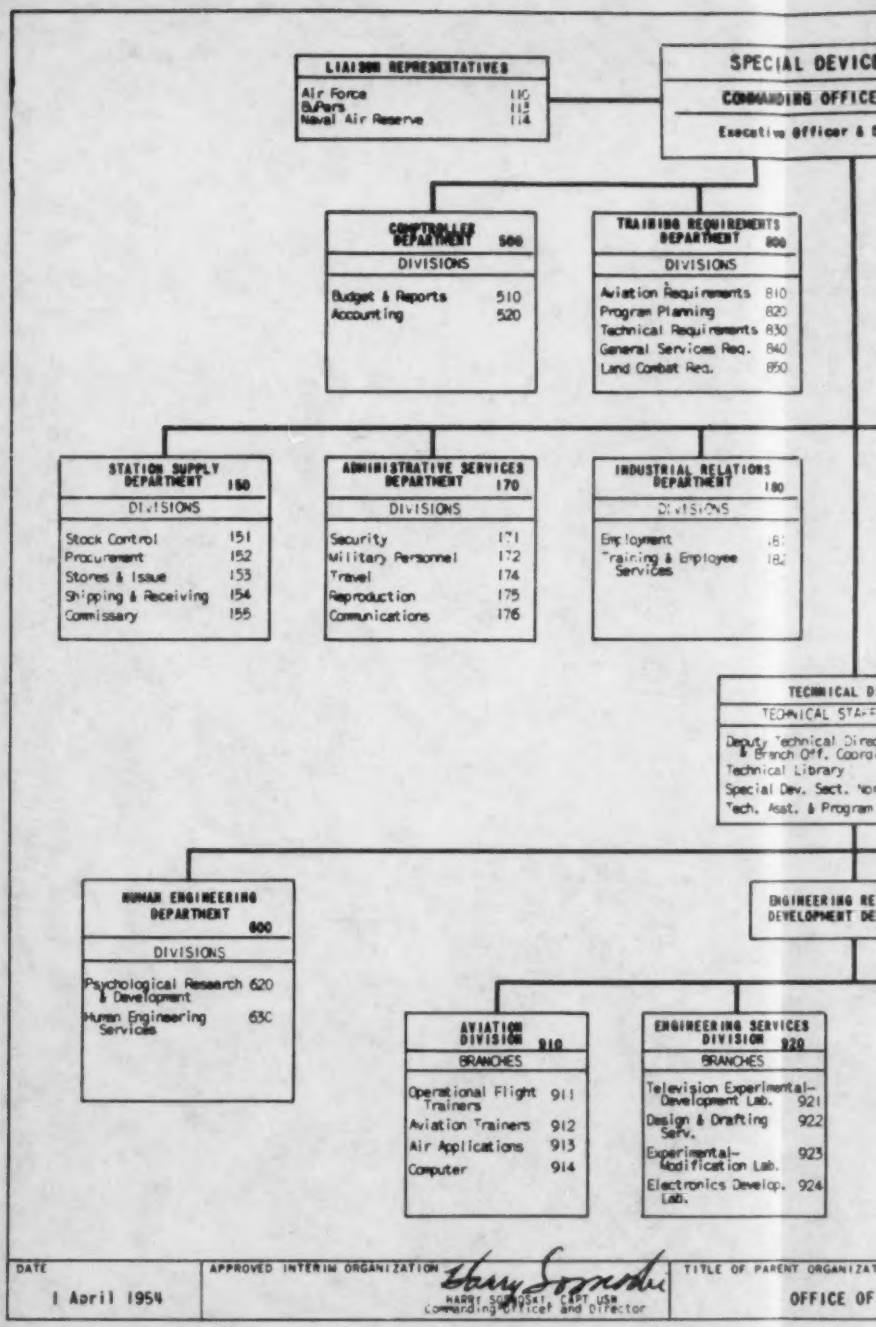
Mr. EATON. I have no idea because the captain has been down in Washington for several days last week and he didn't get back until about noon Monday, and I didn't see him. So, I have no idea what has transpired as far as the organization is concerned now that he is back and getting into it.

Mr. RIEHLMAN. How long was he in Europe?

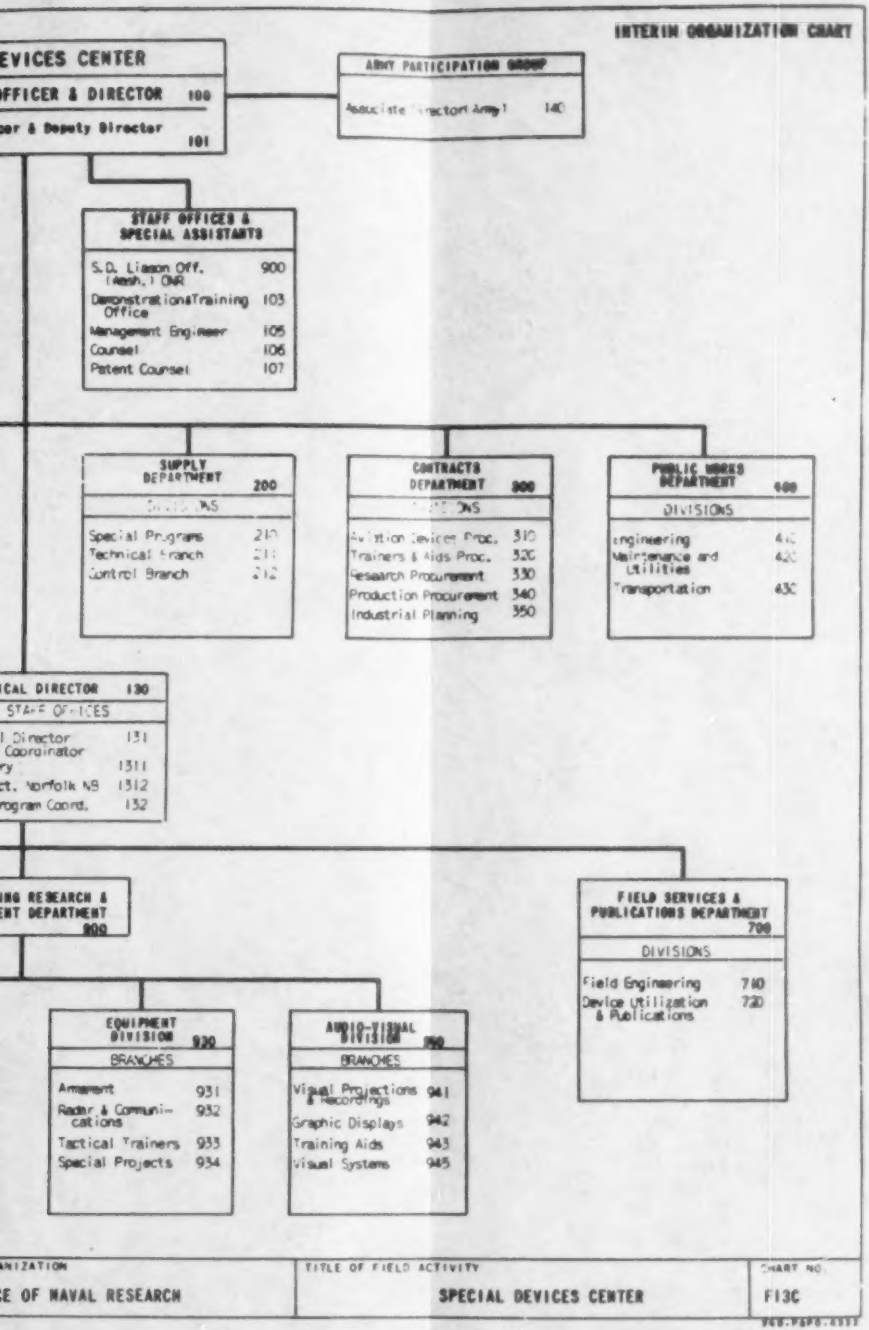
Mr. EATON. Approximately a month.

Mr. RIEHLMAN. What was his tour of duty there? Do you have any idea?





DATE	APPROVED INTERIM ORGANIZATION	TITLE OF PARENT ORGANIZAT
1 April 1954	HARRY SOMOSKI, CAPT USN Commanding Officer and Director	OFFICE OF



ANIZATION	TITLE OF FIELD ACTIVITY	CHART NO.
CE OF NAVAL RESEARCH	SPECIAL DEVICES CENTER	F13C

NAVEXOS-4333

LIAISON OFFICERS

Represent, respectively, the Air Force, Army and Development Command, BUPERS and NAVAIRRES, in matters and activities of interest to these agencies; keep advised of Center's research, development and production programs to eliminate duplication of effort.

SPECIAL

Under CNR, to con
improving the effectiven
search leading to, & the
to fulfill requirements
material support therefor
training techniques & system

Comma

1. Commands and
2. Reports to the Ch
of the mission assig

Executive

1. Represents and
management and coor
command
2. Keeps abreast of
appropriate policy rec
and technical matte

TRAINING REQUIREMENTS DEPARTMENT

Through liaison with the major activities, commands and activities, ascertains training problems, makes training Objectives Analysis and ... more solution; develops and coordinates Training Characteristics, prepares and circulates Training Problem Statements, obtains ... sponsorship and programs projects, maintains project progress cognizance, conducts Training Design Reviews and Training Objective and Test Control Manual Review; assists; makes training effectiveness appraisals and programs device production requirements in the project categories indicated below.

AVIATION TRAINING REQUIREMENTS DIV.

Performs department's functions specifically related to:

a. OFT's.
b. Procedure Trainers.
c. Aircraft Maintenance Trainers.
d. ASW Tactical Training
e. Aerial Mine-laying
f. Aerial Gunnery
g. Aviation Ordnance.
h. AI Trainers
i. Bombing (Radar and

OPERATIONS TRAINING REQUIREMENTS DIV.

Performs department's functions specifically related to:

a. Radar Operator Trainers.
b. Tactical Team Trainers.
c. Ordnance (Surface, Sub-surface and MARCMO)
d. CIC Training
e. Pre and Post Sub-marine Warfare.
f. [illegible]

PERSONNEL TRAINING REQUIREMENTS DIV

Performs department functions specifically related to:

a. Special Weapons
b. AEC Warfare
c. Audio-Visual Trainers
d. HE Research
e. Installations
f. Navy Industrial Training:
1. Motion Imagery
2. Television

LAND COMBAT REQUIREMENTS DIV

Performs functions specifically related to Army Training in:
a. Combat Arms
b. Technical Services.

PROGRAM PLANNING DIVISION

Consistent with CNO Planning Objectives plans and programs research and development projects requirements for the command, recommends priorities; prepares R&D budgetary estimates

OFFICE OF COMPTROLLER

Pursuant to SECNAVINST 5000.9 provides technical guidance and direction in financial matters for the command; formulates Center's financial plan and budget, analyzes program performance and recommends where financial adjustments may be required; directs progress and evaluation reporting systems, performs all accounting functions; maintains civilian payroll and retirement records and prepares payrolls.

BUDGET, REPORTS & STATISTICS DIVISION

Formulates Center's financial plan and budget, administers budget and allocates funds to programs and sub-programs; analyzes performance and recommends where financial adjustments may be made; collects and coordinates

ACCOUNTING DIVISION

Performs program allotment and cost accounting; prepares reports for the command; maintains plant property records, supervises and conducts time-keeping operations; maintains civilian pay, leave and retirement records and prepares

N. AI Trainers
1. Bombing (Radar and Optical).
J. Navigation (Air).
K. ASW (Air).
L. Air Applications.
M. Guided Missiles.

E. Sea and Aerial Submarine Warfare.
F. Navigation.
G. Electronics Trainers.
H. Surface and Subsurface ASW and AEW.
I. Engineering.
J. Gunfire Support Trainers.
K. Amphibious Assault Trainers.

1. Rotary Wing
2. Target Drones

budgetary procedures and [illegible] the Controller, coordinates and plans device production requirements.

collects and analyzes statistical data and prepares periodic and special progress reports.

ment records and prepares reports.

ADMINISTRATIVE DEPARTMENT

a. Responsible for providing office services (mail, messenger, central files, communications, reproduction); provides travel services.
b. Responsible for administration of station security and protection programs.
c. Responsible for administration of all civilian and civilian relations programs, pursuant to NCPI, Civil Service rules and CNR instructions.
d. Responsible for administration of all naval personnel programs pursuant to BUPERS Manual and NAVRES-5; provides pay day services.
e. Responsible for all station supply activities (storage, inventory control, requisitioning, procurement, shipping and receiving).
f. Responsible for all station public works activity (plant and utilities, maintenance and repair, transportation, engineering).

ENGINEE
DEVELOPM
a. Responsible
station trainin
research, design
evaluation, mod
ering.
b. Responsible fo
psycho-physiolog
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automatic and
problems.
c. Responsible f
engineering, labo
direction) neces
coordination of
d. Responsible fo
other technical
Naval Researc

OFFICE SERVICES DIVISION

a. Operates mail, messenger and central file services.
b. Provides communication services (telephone, teletype and radio).
c. Maintains and controls Registered Publications.
d. Provides, operates and maintains central reproduction and duplicating services.
e. Operates and maintains Navy aircraft, provides travel services.
f. Processes travel orders and claims.

MILITARY PERSONNEL DIVISION

a. Administers all naval personnel programs, pro[illegible] by BUPERS Manual and NAVRES-5.
b. Processes all naval personnel actions and records.
c. Provides all routine medical services.

AVIATION TRAINERS DIVISION

Performs department's engineering research, development, maintenance, and production functions as related to:
a. Flight Trainers.
b. Cockpit Trainers.
c. Aircraft Mechanical Trainers.
d. Tactical Aviation Trainers.
e. Aircraft Armament Trainers.
f. Universal Audio Visual Training Aids.
g. Computers.

SECURITY DIVISION

a. Administers station security and protection programs.
b. Carries out applicable provisions of USN Security Manual.

SUPPLY DIVISION

a. Administers pursuant to BUSANDA Manual ship stores program; issues supplies; maintains inventory control.
b. Provides and replenishments; procures [illegible] supplies and services.
c. Stores and receives all plant property; maintains [illegible] programs; operates storage, salvage and scrap programs.

TACTICAL WARFARE TRAINERS DIVISION

Performs department's engineering research, development, maintenance, and production functions as related to:
a. Radar Trainers.
b. Sonar Trainers.
c. Anti-Submarine Warfare Trainers.
d. CIC Trainers.

INDUSTRIAL RELATIONS DIVISION

a. Administers all civilian industrial relations programs prescribed by NCPI, UCS and CNR instructions.
b. Processes all employee personnel actions.
c. Represents Command in employee-group relations.

PUBLIC WORKS DIVISION

a. Operates and maintains all station building and facilities.
b. Performs plant engineering services.
c. Operates and maintains motor vehicles assigned.
d. Controls and dispatches vehicles.
e. Maintains shops. Station Development Plan; maintains liaison with PWO.

EQUIPMENTS TRAINERS DIVISION

Performs department's engineering research, development, maintenance, and production functions as related to:
a. Ordnance Trainers.
b. Special Weapons.
c. Electronic and Navigational Trainers.

SPECIAL DEVICES CENTER

MISION

Under CNR, to contribute to the Navy's operational readiness by improving the effectiveness of Naval training programs through research leading to, ▼ the development & production of training equipment, to fulfill requirements of training agencies; to provide logistic & material support therefore; to study training problems & recommend solutions, training techniques & systems; & to undertake other tasks assigned by CNR.

Commanding Officer & Director

1. Commands and directs the Center.
2. Reports to the Chief of Naval Research on the accomplishment of the mission assigned.

Executive Officer & Deputy Director

1. Represents and acts for the CO&D in the direction, business management and coordination of the Center; executes details of command.
2. Keeps abreast of the technical program of the Center and makes appropriate policy recommendations on administrative, operational and technical matters.

FFICE NPTROLLER

NST 5000.9, provides for aid in financial matters for ...tor; controls financial ...ysis & program performance ...e financial adjustments ...ects progress and operations; performs all accounting civilian pay, leave ...cords and prepares pay...

ACCOUNTING DIVISION

Performs program allotment and cost accounting; prepares reports for the command; maintains plant property records; supervises and conducts timekeeping operations; maintains civilian pay, leave and retire...

ARMY PARTICIPATION GROUP

MISSION

Pursuant to the Joint A N Agreement of 21 March 1950, responsible to DCAFF for research development and production of training aids and devices for the Army and National Guard Bureau.

FUNCTI...

C...

OFFICES, SPECIAL ASSISTANTS

ONR SPECIAL DEVICES LIAISON OFFICER	COUNSEL	PATENT COUNSEL	TECHNICAL INFORMATION OFFICER	MANAGEM... ENGINE...
Pursuant to ONRINST 5430.1, maintains continuing liaison between the Center, CNR, CNO and NAVDEPT; provides staff assistance to CNR and as directed acts for the CO&D, SPECDEVCEN.	Representative of the Office of the Navy ... Council; provides all legal advice and ... to the Center in the fields of ... and business law ... as adviser and consultant to the command on other legal matters.	Provides advice and services relating to patents, inventions, copyrights, royalties and related matters.	Provides staff assistance and advice to the command on clearances and release of technical information on the activities and projects of the Center in accordance with NAVMATINST, USN Security Manual and ONR policy.	Provides manag... engineering assistan... vices for the comma... management, organiz... procedural improvem... and audits; administ... budgetary prescribed ... programs.

civilian pay, leave and retirement records and prepares reports.

ENGINEERING, RESEARCH & DEVELOPMENT DEPARTMENT

a. Responsible for prosecution of contract and organization training equipment and training aid engineering, research, design development, standards and evaluation; maintenance engineering; production engineering.

b. Responsible for contract and in-house psychological and physiological human factors research problems, applicable to design of training equipments and man-machine relationship; provides human engineering consultation and guidance in training equipment design problems.

c. Responsible for providing and operating supporting engineering laboratories and shop facilities; and directing engineering, technical fiscal, maintenance services, and coordination of training equipment engineering specifications.

d. Responsible for executing supporting research and other technical programs directed by the Chief of Naval Research.

MATERIEL & SERVICES DEPARTMENT

a. Responsible for execution of inventory and supply management programs in support of training equipment maintenance, its parts, assurance symbol "T".

b. Responsible for matters relating to research, development and production contracts for training equipment, utilization material and supporting research.

c. Responsible for field service programs, involving installation, maintenance, servicing, overhaul and depot, rehabilitation and modernization of training equipments, assurance symbol "T".

d. Responsible for execution of programs designed to assist training activities obtain optimum utilization of training equipment, assurance symbol "T".

...ATION TRAINERS DIVISION

...g engineering research, development ...olution of systems as related to:

...ircraft Trainers.
...ion Trainers.
...Visual Trainers.
...ew Training Aids.

...AL WARFARE ...S DIVISION

...ipment engineering research, develop... and production functions as related to:

...ers.
...ns.
...Marine Warfare Trainers.
...s.

...ENTS TRAINERS DIVISION

...ment's engineering research, develop..., and production functions as related

...rainers.
...ons.
...and Navigational Trainers.

AUDIO-VISUAL TRAINERS DIVISION

Performs department's engineering research, development, modification, and production functions as related to:

a. Classroom Training aids and demonstrators.
b. Recordings and film productions and scripts.
c. Projection presentations; terrain and recognition models.
d. Evaluations, audio-visual simulators and systems trainers.
e. Self-scoring trainers.
f. Audio-visual media, system and component research.

ENGINEERING SERVICES & LABORATORIES DIVISION

a. Operates experimental, test, evaluation, modification and repair, mechanical and electronic shop and laboratory facilities.

b. Provides TV technical services and studio facilities.

c. Provides design and drafting services.

d. Operates technical reference library and provides bibliographic research services.

e. Maintains and services master engineering device drawings and photographic files.

HUMAN ENGINEERING & DIVISION

a. Conducts and guides contract and in-service research in human factors capabilities and limitations applicable to the human factor in training design, operation and use of training equipment, to improve man-machine efficiency and performance.

b. Furnishes human engineering and human factors consultation services to training equipment project engineers.

c. Determines needs for supporting human eng. research.

PROGRAM (SUPPLY) SUPPORT DIVISION

Administers supply management and technical supply functions for supply support of training devices, cognizant symbol "T", pursuant to ONR/BUSHIPS Memorandum of Agreement, approved by SECNAV, 28 Jan 1954.

CONTRACTS DIVISION

a. Executes contractual matters related to research, development and production of training devices, human engineering and other supporting research.

b. Negotiates terms of all research and development contracts; issues requisitions to NPO NY for production of training devices.

c. Processes contract amendments, terminations and other actions.

d. Administers industrial mobilization program.

FUNCTIONAL ORGANIZATION CHART

OFFICE OF NAVAL RESEARCH
SPECIAL DEVICES CENTER
PORT WASHINGTON, NEW YORK

19 APRIL 1954

N GROUP

...ment of ... for ... ...ns of ... Army

L ASSISTANTS

	TECHNICAL INFORMATION OFFICER	MANAGEMENT ENGINEER	FIELD LIAISON OFFICER
...ies.	Provides staff assistance and advice to the Command on clearances and release of technical information on the activities and projects of the Center in accordance with NAVMEGS, USN Security Manual and ONR policy	Provides management engineering assistance and services for the command; conducts management organization and procedural improvement surveys and audits; administers all bureau prescribed management programs.	Coordinates activities and is liaison point between the Center and ONR BD's; provides direction, administrative and technical guidance to SDCEE's and field representatives; inspects SPECDEVCEN field activities; as directed, is liaison point for SPECDEVCEN Material Inspection Agency relations.

MATERIEL & SERVICES DEPARTMENT

a. Responsible for execution of inventory and supply maintenance programs in support of training equipment and aircraft parts, maintenance symbol "T".

b. Responsible for matters relating to research, development and production contracts for training equipment, utilization material and supporting research.

c. Responsible for field service programs, involving installation, maintenance, servicing, overhaul and repair, rehabilitation and modernization of training equipment, maintenance symbol "T".

d. Responsible for execution of programs designed to assist training activities obtain optimum utilization of training equipment, maintenance symbol "T".

UPPORT

cement and tech-
ty support of train
T", pursuant to
Agreement, approved

MAINTENANCE DIVISION

a. Installs, maintains and services training devices.

b. Implements modifications, directs overhaul and repair, rehabilitation and modernization programs.

c. Operates a "feedback" system of technical use and service data.

d. Programs and plans use of funds for installation, maintenance, overhaul and repair of training devices.

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other supporting

arch and development
NPO NY for

nts, terminations

ilization program.

UTILIZATION & PUBLICATIONS DIVISION

a. Plans and conducts device utilization programs and projects to assist training activities achieve optimum use of training equipment.

b. Develops, writes and edits device publication and other utilization materials; arranges for printing and reprinting as required.

c. Plans and coordinates TRADSMEN and Reserve officer training programs.

d. Introduces and demonstrates devices to using activities.

Mr. EATON. Well, it was to look over training devices England has developed and also to visit some of the other—I don't know what they call them—mutual-aid defense. It is like the MDAP, except it is the actual operating organization. It is MAAG-something, I believe.

Mr. RIEHLMAN. I can't figure the initials.

Mr. EATON. I can't either. It is the same thing, though, but it is a question of what countries like Spain, Portugal, and some of those would need in the way of military training devices.

The only other thing that I believe might be of interest to the committee, as far as the personal thing is concerned: I have used Admiral Bolster's name, the retired Chief of Naval Research's name, on some references in looking around for my next field of endeavor.

Mr. BALWAN. Is Admiral Bolster retired?

Mr. EATON. He retired on the 1st of January.

Mr. RIEHLMAN. 1954?

Mr. EATON. Yes.

Mr. BALWAN. And was succeeded by whom?

Mr. EATON. Admiral Furth.

Mr. BALWAN. Admiral Furth?

Mr. EATON. Yes.

Mr. BALWAN. Where is he now?

Mr. EATON. He is with the General Tire & Rubber Co. I believe he is either an assistant or an associate director of research.

Mr. BALWAN. Did he retire because of age; do you know?

Mr. EATON. I believe his normal retirement would have come up the 1st of July, but I believe this position came along and that he had his retirement moved up 6 months.

I would like to quote one paragraph here from a personal letter from him dated May 7, 1954:

> I am very sorry to hear that things have not worked out well at SDC. I abhor the thought it is undergoing still another sweeping organization, as in my opinion the poor place has been reorganized to death already.
>
> I also feel the philosophy of putting officers in key spots, such as yours, is a most unfortunate mistake and I am surprised to hear the Chief of Naval Research has approved such a move, although, of course, I do not know what his policies in this regard are.

Mr. RIEHLMAN. This Admiral Bolster was the officer who in three different instances commented upon your capabilities and the manner in which you had operated that shop; is that correct?

Mr. EATON. No; he did not comment. Those were comments by Captain Haley.

Mr. RIEHLMAN. Oh, yes; I beg your pardon. That is right.

Mr. EATON. He was reviewing officer.

Mr. RIEHLMAN. That is right.

Mr. EATON. And his assistant, Captain Grimes, reviewed.

Mr. RIEHLMAN. That is right; but he was aware of your activities?

Mr. EATON. I feel certain.

Mr. RIEHLMAN. And the accomplishments you had made in that reorganization program?

Mr. EATON. Well, in response to my asking if it was O. K. for me to use his name as a reference, he said:

> In regard to your own future, I received a call about 2 weeks ago and was happy to serve as a reference in this regard.
>
> I certainly hope things have worked out well for you and wish you every success in your new undertaking.

Mr. BALWAN. Mr. Eaton, you mentioned something to the effect that there were other people who had left the Naval Special Devices Center, technical people.

Mr. EATON. Yes. There has been some attrition. I wouldn't like to say right offhand whether it is more right now than less. I have a feeling I have signed more resignations in the last 6 or 8 months than I have before, but I wouldn't want to go on record as saying that is so because that is somewhat seasonal, and everything; but I intuitively feel it is a little higher.

Mr. BALWAN. Is that due to this increasing military control or does that not affect people at that level?

Mr. EATON. I doubt if it is affecting those people too much, except it is just some addition to it.

I don't know if you want to enter any of this in the record, of an engineer, a junior engineer, who left, or his comments relative to the military.

Mr. BALWAN. Mr. Riehlman, I believe these are some very pertinent comments, which are taken from a letter of resignation by some of Mr. Eaton's employees, or one of the employees.

Mr. RIEHLMAN. Now, this letter is directed to you.

Mr. EATON. This letter was attached to the standard form 52, which is a resignation form in civil service. The chap's name is Robert W. King, Jr., and he submitted a 22-paragraph or 21-paragraph comment on the center in general, of which about 6 had to do with his reactions to the military. There are a couple here which I think I might read, and the others I think it will be all right if you want to keep this for a while and peruse over it.

Mr. RIEHLMAN. I would like to have a copy of the letter, if you will make available a photostatic copy of it.

Mr. EATON. In that case, to save time, why don't I just——

Mr. RIEHLMAN. I think it would be best to have you read the two paragraphs that you are suggesting into the record.

Mr. EATON. All right.

Paragraph 6:

> The projects at the center are often confused by the periodic changes in military personnel at the center who are responsible for overall direction or military requirements. For example, frequently a device will be started under the production of one officer who leaves prior to the completion of the device; then another man takes his place and begins to inject his own ideas and change the approach to the subject, to the annoyance and confusion of both the project engineer and the contractor.

Paragraph 18:

> There is another failing among naval officers that causes trouble. They have the feeling they know more than their subordinates about any topic. This attitude probably derives again from naval training, where each officer is trained in all naval skills and, therefore, does know more than his juniors in the Navy; but civilian engineers are quite often specialists and know more about their specialties than any naval officer, even though they may be subordinates in the organization.

Those are just two of the pertinent observations here.

Mr. BALWAN. I think that completes the description of the case study, Mr. Riehlman, which I think is a very interesting one, and it shows how the military can come into the picture gradually.

I have no further questions, except to propose that we provide Mr. Eaton—and we haven't heretofore—with a list of questions that we sent to some other people; and if he has any comments concerning

some of our hypotheses about the operation of research and development centers, I think it might be helpful.

Mr. RIEHLMAN. I think it would be very helpful, and we will be delighted to furnish him with the questions and have his answers, and insert them with the other answers of scientists we have asked these same questions of.

I deeply appreciate, Mr. Eaton, your taking time to give this important information to the committee.

I don't know whether you would care to make any statement on what you anticipate will happen in that operation under the present circumstances.

Mr. EATON. Well, you can force by brute force anything to work. There has been a lot or reorganization, apparently, up there. I tried to take the organization as it was, weld it into a team, set up procedures that would require that it work as a team and not make any changes except as necessary, like changes in scope of operation or in one case I had, because of civil service regulations, not being able to remove a man right out, relieve someone who did not have good administrative ability and shift him around so he was in a less administrative capacity.

Those are about the only changes that were made, except, as I say, something like this contract thing, which was a means to getting something accomplished, but which, unfortunately, didn't happen.

Mr. RIEHLMAN. Mr. Lipscomb, did you have a question?

Mr. LIPSCOMB. Yes, Mr. Chairman.

I would like to go back to these organization charts for a second.

The one of March 25, 1954: There was an officer of the Navy proposed in this position of engineering research and development department; is that right?

Mr. EATON. That has never been definitely spoken of by the captain one way or another. I mean he is noncommittal on that. My own belief is, though, knowing the way the Bureau of Aeronautics organization is set up, that would have to be an officer in that case, and probably a GS–15 here.

Mr. LIPSCOMB. And the proposal on this particular chart did not include a civilian technical director?

Mr. EATON. No; there is no technical director here.

Mr. LIPSCOMB. Then the next one that came out was on April 1, 1954, but on this particular chart they did include a technical director?

Mr. EATON. Well, this is an interim chart.

This is the way the thing is operating right at the moment.

Mr. LIPSCOMB. At the present time?

Mr. EATON. These are proposed.

This is an actuality.

Mr. LIPSCOMB. So, you are actually operating under this one?

Mr. EATON. That is right.

Mr. LIPSCOMB. Then, under this latest chart, April 19, 1954, the engineering research and development department, it is anticipated that they have a military person on here?

Mr. EATON. That I still don't know.

Mr. LIPSCOMB. I see.

Mr. EATON. The captain has been very noncommittal about this, and all I get is scuttlebutt that the present acting commander here

can have the job as long as he wants and there has been no effort made by the commanding officer to recruit for the GS–15 position.

Mr. LIPSCOMB. Do you know of any more recent chart than April 19, 1954?

Mr. EATON. This is the last one I know of.

Mr. LIPSCOMB. And you don't know of any definite plan or proposal that they have now?

Mr. EATON. No, because, you see, this wait order from ONR came to Commander Hall when the captain went to Europe, and he didn't get back until around the 15th or 17th of May, and he has just again gotten active in attempting to resolve this organization problem with ONR.

Mr. LIPSCOMB. Your resignation has been accepted?

Mr. EATON. Yes; my resignation was accepted.

I don't think there is any date here, but Secretary Smith signed it, and it will be effective as of July 3.

Mr. LIPSCOMB. And are you aware they are looking around for someone, some civilian, to take your place?

Mr. EATON. No; I am not aware of it.

Mr. LIPSCOMB. As technical director?

Mr. EATON. No; because all I can go by is what is here, and that is, there will be no technical director.

Mr. RIEHLMAN. There will be no technical director?

Mr. EATON. All I am going by is these charts.

Mr. RIEHLMAN. The charts?

Mr. EATON. Yes.

Mr. LIPSCOMB. From what you can see of it on the face, you can see they are going to put a military person at the head of the civilian scientists who are on duty at the Special Devices Center?

I mean that is as far as it looks to you?

Mr. EATON. I feel that way because, knowing the captain wants to set up an organization like the Bureau of Aeronautics—then it would be normal in that case to have a military person there.

However, that again, as I say, is in discrepancy with the second endorsement here by Admiral Furth, because it says if and when organizational changes are made, then this establishment of Public Law 313 job will be the subject of further correspondence.

So, this, to me, is an unknown factor.

Mr. LIPSCOMB. No one in the Navy Department has approached you to stay on any longer?

Mr. EATON. No.

Mr. LIPSCOMB. Than July 1?

Mr. EATON. No.

Mr. LIPSCOMB. To keep this operation in good form?

Mr. EATON. No.

I mean it is in very poor form, even with this interim chart. I mean I wouldn't even want to consider the thing, even with this.

Mr. LIPSCOMB. The reason for that is this executive officer and deputy director is——

Mr. EATON. For two reasons: That, and the fact that military requirements have been taken out from under the technical control and their particular operation, in addition to being contacts to field activities, and so forth, is setting up priorities and program planning of funds, research and development funds.

Mr. LIPSCOMB. Just one other question.

Mr. RIEHLMAN. Yes, sir.

Mr. LIPSCOMB. Do you happen to know the background of the executive officer and deputy director, other than his military service?

Mr. EATON. Other than the fact he had a good military service and submarine officers have the equivalent of an engineering degree. They go through the New London school.

Mr. LIPSCOMB. That is all I have.

Thank you.

Mr. RIEHLMAN. Are there any more questions?

Does any member of the staff have any questions?

Mr. BALWAN. I have just one.

Mr. RIEHLMAN. All right.

Mr. BALWAN. We were told that it is impossible to have a new commanding officer come in and change the office running a center. How is this possible in this case?

Mr. EATON. Well, I think the immediate possibility is that any chief immediately above him is going to rely on his recommendations.

Mr. BALWAN. You were told that no commanding officer could change the method by which a base is operated without the approval of the Bureau Chief?

Mr. EATON. That is correct.

Mr. BALWAN. What you are saying is the Bureau Chief doesn't know how the base is operating; so, he is going to ask for advice from the commanding officer?

Mr. EATON. That is right.

Mr. BALWAN. So, in effect, this would just circumvent——

Mr. RIEHLMAN. That is right.

Mr. EATON. And it depends then entirely on whether the commanding officer in this particular case wants to call on the technical director, which he did not desire to do.

Mr. RIEHLMAN. Do you have any knowledge of any other instances such as this?

Mr. EATON. Only what I have been told, and that is the Naval Ordnance test station, and I don't know any of the details of these. That is the trouble.

Mr. BALWAN. What station did you mention?

Mr. EATON. Naval Ordnance test station.

Mr. BALWAN. At——

Mr. EATON. Inyokern.

Mr. BALWAN. Inyokern?

Mr. EATON. Yes.

Mr. BALWAN. And the chief scientist is leaving there?

Mr. EATON. He has left.

Mr. BALWAN. He has left.

Mr. EATON. I believe it would be better if Dr. Black could answer that because——

Mr. BALWAN. He knows these people?

Mr. EATON. He knows the people, or the instances, better than I do.

Mr. RIEHLMAN. I would like to say this to you, Mr. Eaton: That we again express our appreciation for your giving your time to come down here and give this committee the information that you have. It is most helpful, and I am sure can be used in a constructive way by this committee.

I regret that the hour is so late and that so many of our members have had to leave the subcommittee.

Unfortunately, this thing does happen when you have legislative schedules of programs and you never know when you are going to be called upon to leave a subcommittee or a full committee.

However, I want to assure you that the members will read the testimony with a great deal of interest, and very carefully.

Now, as to the other 2 gentlemen, I think it would be a gross mistake to ask you 2 to testify before just 2 members of this subcommittee and not permit the other members to hear what you have to say. It is very important, and we need the information from outstanding people of your background and experience to help us do a constructive job or, may I say, write a constructive report, and I hope that we will be able to do just exactly that in this great field of research and development, which I am sure you recognize a great deal more than I do the importance of its continuing in a very smooth and progressive way.

So, I think it will be necessary to adjourn and try, if we can, to get you two gentlemen to come back at a later date.

I just feel terrible that we have to do it, but I hope that you understand it is not the chairman's will or wish, but it is just one of those things that does happen in a hearing such as this.

Would that be agreeable to you two gentlemen?

Dr. BENNETT. I would be very happy to come any time.

Mr. RIEHLMAN. Thank you very much, Doctor.

Dr. BENNETT. Any time I can get here.

Mr. RIEHLMAN. I know you live up in New York City, or apparently I have been informed of that.

Mr. BLACK. There are sometimes a few awkward difficulties, but Mr. Balwan is quite skillful at working out a suitable arrangement. So, I will be glad to try to fit in my time any time he cares to schedule it.

Mr. RIEHLMAN. Thank you very much.

Mr. BALWAN. Mr. Riehlman, these three gentlemen have been extremely helpful to the committee staff in carrying out this work. In no case did these gentlemen seek out the committee. We heard about the incidents. We went out to talk to them. In the case of Dr. Bennett, who has been in Europe, we talked with his deputy about a week ago. Dr. Bennett returned last Monday or last Friday—I am not sure when.

Dr. BENNETT. Thursday.

Mr. BALWAN. And in his case, he has an outstanding laboratory where they are trying to demonstrate how a good laboratory runs and show examples of how this situation exhibited at the Navy Special Devices Center could not occur at the Navy Ordnance Laboratory, and it is very impressive.

Mr. RIEHLMAN. With that, I think the committee should recess, and we will meet tomorrow morning at 10 o'clock in this same room, at which time we expect to have the special Assistant to the Secretary of the Air Force as a witness.

(Whereupon, at 6:08 p. m., the hearing was recessed until 10 a. m., Thursday, June 10, 1954.)

ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

THURSDAY, JUNE 10, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON MILITARY OPERATIONS OF THE
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met at 10 a. m., in room G–53, United States Capitol, Hon. R. Walter Riehlman (chairman of the subcommittee) presiding.

Mr. RIEHLMAN. The subcommittee will come to order.

This is a continuation of our inquiry into the program of research and development in the Defense Department.

This morning we are honored to have with us the Special Assistant for Research and Development in the Office of the Secretary of the Air Force, Mr. Trevor Gardner. We have had the privilege of discussing a portion of this problem at a previous meeting at the Pentagon with Mr. Gardner, and we were certainly pleased and delighted with the reception we were given over there and the manner in which they presented their program at that time, and I am sure we will be pleased with the presentation today.

With that introduction Mr. Gardner may proceed with his statement.

Mr. Gardner, I understand you have several assistants with you. If you would like their names on the record, we will be glad to have them, because if they are going to present additional information it would be well to have their names so that the recorder will know who they are. If the gentlemen who will take part will stand and give your name and title or rank, it would be very helpful as we move into the discussion.

Mr. GARDNER. We had not planned to call on any of these gentlemen unless some question is asked that I have no specific answer to.

Mr. RIEHLMAN. Then let us wait for that time. Also, I think we should have the record show the members who are present here this morning.

(Subcommittee members Riehlman, Lipscomb, and Lantaff were present.)

TESTIMONY OF TREVOR GARDNER, SPECIAL ASSISTANT FOR RESEARCH AND DEVELOPMENT, OFFICE OF THE SECRETARY OF THE AIR FORCE

Mr. GARDNER. Mr. Chairman, I am here in response to your letter to Secretary Talbott, and would like to address myself to the six points which you mentioned and then, with your permission, deal separately with the problems listed as item 7 in your letter.

NOTE.—Asterisks denote classified material deleted.

The first item is the scope of the research and development program, and at this point, in order that we may have a rather frank discussion of this, I would like to go off the record, if that is satisfactory with you.

Mr. RIEHLMAN. This is an executive session.

Mr. GARDNER. This is the only part I wish to go off the record on.

Mr. RIEHLMAN. May we put it in the record and mark it as secret, so that that part will never be used in any way in the hearings if they are made public at a later date?

Mr. GARDNER. That is satisfactory.

Mr. RIEHLMAN. Is that agreeable to the committee?

All right.

Mr. GARDNER. Before discussing the Air Force research and development program—and incidentally, this is the only one of the questions you ask which does not relate directly to the management of our research and development program—I have tried to think about what you might want when you use the word "scope," so if I do not give you the information you need I will be glad to supplement it.

Mr. RIEHLMAN. That is fine.

Mr. GARDNER. Before doing that, I might do what Mr. Quarles did and tell you a little bit about my qualifications for doing this particular job.

I am a graduate engineer, bachelor of science degree, and followed that with master's degree in business administration, with a major in management. I have made the management of matters technical, and lately research and development, a part of my professional training.

Previously I was president of a company employing about 1,000 people, operating in a very technical field, and during the war I was in the Office of Scientific Research and Development at the California Institute of Technology, where I was development engineer on the rocket and atomic bomb projects.

In talking about the scope of the Air Force research and development program, I would like to talk about the thing that has impressed me most about the program, and that is that the very difficult things we are trying to do are not getting any easier. They are getting constantly more difficult. I have recently reviewed our technical objectives in several fields. In the field of defying gravity, for example, which fundamentally is what a large part of our program is all about, we are trying in the next 2 or 3 years to attain an altitude for our airplanes which is approximately twice what we have been able to attain today. In other words, we are trying to accomplish in 2 or 3 years what has been accomplished to date.

In developing electronic components the temperature and vibration spectra have to be designed for 3 years from now and have to be approximately twice as good as we are able to do now. The point I am trying to make is that we are getting in the high speed part of the accomplishment curve, and therefore the barriers are becoming much more complex.

We talk very glibly of the speed of sound, which we call Mach 1. Newspapers have started talking about Mach 2 and 3. Since it has taken 50 years to learn to fly airplanes to Mach 1, the presumption

is it might take another 50 years to learn to do twice that. We are trying to get Mach 2 airplanes in much less than 50 years.

I am setting this backdrop because the whole end result which our management effort is supposed to accomplish is getting increasingly more difficult. We are trying to make the radar in our interceptors see approximately twice as far. We need to see twice as far if we are going to use the speed.

Mr. RIEHLMAN. May I interrupt you at this moment? I would like to say the reason I want this on the record is that Mr. McCormack and other members of the committee who are not here will want to read it. I assure you that no security information will be made a part of the printed record should any part of this record be made public in the future. I want to assure you of that.

Mr. GARDNER. Thank you.

In order to do our job more effectively, we have set up Project Lincoln, which is housed at the Cambridge Laboratory. Project Lincoln has a very simple job, if stated simply, but a very complicated technical responsibility. We have about 1,500 people trying to accomplish this job. Stated simply, it is to be able to identify, at higher altitudes and at greater distances, with electronics, airplanes, or even missiles, and to be able to do something about that identification in terms of using fighters or guided missiles to accomplish their destruction. We are trying to increase by a factor of 10 or perhaps 20 our continental defense capability in a very few years through the work being done at Lincoln. Whereas we normally would expect this might take longer than a few years, we have to attempt to collapse the time scale.

I think this committee has reviewed what we are doing in guided missiles. In all of these fields, because of the degree of difficulty involved, none of us are happy or complacent about what we are doing. Since I have been in the Air Force I have gone through alternate periods of encouragement and despair. Where we have had difficulty I have found the military quite willing to review our problems and render assistance as new technology arrives on the scene. We try to take full advantage of all technological advances that occur.

Even though there has been a lot of criticism of research and development, I would like to assure the committee that our laboratories are causing many inventions and many technological breakthroughs to occur. I can enumerate a few so that you will see that this statement has some substance.

* * * * * * *

I think the most reassuring fact for this committee to consider is that we are getting this kind of result, whether our management is good or bad. This means that airborne radar for the extension of our early warning lines can now be practical, whereas before there was some serious doubt about it.

I can give you some other examples in the inshop work at the WADC laboratory at Wright Field. That is inhouse research and development, supported somewhat by industry but principally coming from the laboratory itself. They have been able to accomplish many things in the field of improved materiels. One of the most recent and most spectacular things I have seen accomplished in that laboratory was the technique of plating titanium on steel for the first time.

The steel bolt was previously placed in an acid bath. After one week of immersion it showed no corrosion. This is not an invention, but it is the kind of thing we can accomplish.

I could give you more examples of specific accomplishments.

Mr. RIEHLMAN. I think those would be sufficient at this time, Mr. Secretary. We appreciate that information and it is certainly helpful to the committee.

Mr. GARDNER. I have here some budget figures concerning the scope. I presume by scope you mean our research and development program?

Mr. RIEHLMAN. That is right.

Mr. GARDNER. Before I do that, I would like to talk about the management structure behind the scope. I feel my most important job for Secretary Talbott is to be able to assure him that we are doing research and development on the right things. I felt initially that this was more important than an examination of the management structure. Accordingly the first 8 months or so of my work was devoted to acquiring an understanding of our program.

I was amazed to find there was a lot of sense and system to the manner in which our weapons systems are developed, and the programs on which we work. The first means for doing this is a group which works on futures. They develop what the Air Force, 10 years from now, might look like. There is a document on development planning called a development planning objective which lays out the objectives so that they might bring into fruition the types of development that are feasible and necessary in order to keep ahead of our enemy in the years ahead. I consider our development planning activity one of our most important Air Force activities, because the management and the program itself is no good unless it fits into a comprehensive plan—a plan which assures you and the people of the United States that we will remain superior, through our research and development activity.

Mr. BALWAN. Who does the development planning?

Mr. GARDNER. The Office of Development Planning is under General Schriever.

Mr. COTTER. Is that a military group?

Mr. GARDNER. It is a military group and it is supported by a contract with the Rand Corp. and with universities. The Rand Corp. employs about 615 people, about half of whom have technical degrees.

These development plans are for strategic air, continental defense, and so forth, to give major guidance to the evaluation of our development program.

Mr. BALWAN. Would it be out of place, Mr. Chairman, to ask more about what the Rand Corp. is?

Mr. RIEHLMAN. No. I think it would be very helpful.

(At this point committee member McCormack arrived at the hearing.)

Mr. BALWAN. Would you tell us who they are and what they do?

Mr. RIEHLMAN. And the universities that work with them.

Mr. GARDNER. We have recently, from my office, made a complete examination of the contract with the Rand Corp., and have asked a number of questions, for example, what has Rand contributed in the way of important technical direction to the Air Force in the past 2 years; what projects is Rand working on at the present time; how many people do they have; how well are they qualified; how much

control do we have over them; and similar questions. A very complete report was made to my office, after which a number of questions were asked, so I can answer your questions with some authority and with some accurate recent information.

There are 617 full time employees at Rand. Approximately 55 percent of these have technical degrees. As I remember, 157 have doctors degrees. Rand employs in addition to that a number of consultants. I do not necessarily mean that a Ph. D. degree means a man is bright, but it is one yardstick for measuring technical and analytical competence.

Rand is divided into six divisions that roughly correspond with the divisions of strategic air defense, tactical air, and so on. One division addresses itself to nuclear problems. They work on projects of their own initiation, with Air Force funds when approved by the Air Force, and on some other projects with their own funds. They are a nonprofit institution. This does not mean we do not pay them a fee. They receive a fee on their contract, but this fee has so far just been used to increase their working capital. At the point that working capital reaches a certain level, they begin plowing the excess part back into their own research program.

Rand operates almost as a technical assistant to our military air staff. They are all civilians, although we do have a few Air Force officers assigned there from time to time. Rand works closely with all echelons of the Air Staff and with the commands.

Since I come from southern California, I have heard about Rand in various ways for a number of years, and I went into the investigation somewhat critically where the research is principally paper and plans. After examining the Rand papers and their impact on the Air Force and the kind of things they were working on and the people running it, I feel that the Air Force is getting its money's worth from Rand. I feel they have made not one but many contributions during the past few years.

We have been a little critical that perhaps they were working on too many things and, very frankly, this is a matter of judgment and capacity. They appear to have the capacity. I personally would be happier if we could get Rand to concentrate on less projects than they have. At the present time they have 152 studies in process, some of them large and some small. Ten of these studies account for almost $2 million of the $6 million we are giving Rand each year.

Does that answer the Rand question?

Mr. RIEHLMAN. I think it does.

Mr. BALWAN. Who heads up Rand?

Mr. GARDNER. Frank Collbohm heads it up. He is the director. And there is Dr. Lee DuBridge, president of California Institute of Technology, and Rowen Gaither of the Ford Foundation, who are members of the board of trustees.

Mr. BALWAN. Is this a joint venture?

Mr. GARDNER. It is not. It is a private nonprofit corporation.

Mr. COTTER. How was it conceived and how did it gain its importance in relation to the Air Force?

Mr. GARDNER. At the end of World War II it was apparent that new weapons were arriving on the scene at a tremendous rate, not the least of which was the atomic bomb. The impact of these new weapons on the Air Force was not clear. What was clear was that if we

did not examine the impact in an objective and realistic way we certainly would not remain superior in the air. As you will recall, at the end of World War II we were looking at the Luftwaffe, which had flown the first jet airplane; and we were looking at the Russians, with rockets as good as ours; and we were looking at the British, who had come up with the turbojet engine; and we were looking at the Swedes from whom we had to borrow the Oerlikon gun. We were looking at wind tunnels the Germans had conceived and had in warehouses when we were not even thinking of wind tunnels.

Mr. McCORMACK. When was this?

Mr. GARDNER. At the end of World War II. General Arnold and General Doolittle and others appreciated this and set up an inquiry as to what might be done about it, to which I refer later, the so-called Ridenour report. They did a number of other things, such as the determination that we should have, must have, a large wind tunnel; we must have a guided missile test range; we must have a scientific advisory board to the Chief of Staff, and some sort of entity which could, on a continuing basis, feed the Air Force with analyses of promising ideas. This entity could not be found in the Air Force but was found in a group located at the Douglas Aircraft Co. The group began their work there, but when it appeared they would be a technical servant of our Air Force, it was appreciated if they remained at Douglas they might certainly be accused of having a bias, so in order to give this group as unbiased a flavor as possible, in a world filled with bias, the Rand Corp. was formed. Do you know about when that was?

Colonel JOHNSTON. In the vicinity of 1947.

Mr. RIEHLMAN. Will you state your full name for the record, please?

Colonel JOHNSTON. Col. R. L. Johnston, Technical Director in the office of Brigadier General Kelsey, Deputy Director for Research and Development.

Mr. GARDNER. Any other questions on Rand?

Mr. BALWAN. Can Rand initiate projects?

Mr. GARDNER. It can initiate projects. There is a group set up by the Air Force to monitor and control the Rand projects. Some projects they initiate they work on with Air Force funds, where approved by the Air Force, and some, whether we approve them or not, if they want to use their own funds they may work on them.

Mr. BALWAN. To whom do they report?

Mr. GARDNER. The contract is with the Air Research and Development Command. It is under the direction of General Shriever and is coordinated through General Schriever's office. However, our operations people might ask them to do a job on war games, for example.

Mr. BALWAN. Do they submit a budget each year?

Mr. GARDNER. They do. I have a detailed breakdown of where that budget is applied.

Mr. BALWAN. Do they list the projects?

Mr. GARDNER. They list the projects.

Mr. BALWAN. Do you approve the projects? Is continuance of the contract based upon the projects approved by you?

Mr. GARDNER. That is correct. The projects which they submit to us and which we fund are projects approved by us.

Mr. COTTER. Is the Air Force the sole source of their income?

Mr. GARDNER. Not completely. This is a very controversial point and one on which you can get several answers. I will have to be very frank about it. There is not an agreement, but there is an accepted practice that Rand will tend to concentrate on our Air Staff problems. They have taken jobs for the Army and they have taken contracts with the Air Defense Command directly. So they do things other than the $6 million contract.

Mr. COTTER. But not for private industry?

Mr. GARDNER. They have not done anything for private industry to the best of my knowledge.

Mr. BALWAN. Where they are dealing, let us say, with guided missiles, in view of the fact the Army and Navy are dealing with them also, to what extent do the other services have the information developed by Rand?

Mr. GARDNER. There is a distribution list, which is approved by General Schriever, and if I am not mistaken included on that are various members of the Army and Navy and the Assistant Secretary of Defense for Research and Development who receive automatic copies.

Mr. MCCORMACK. Who are on that list?

Mr. GARDNER. People who have a need to know the information. Some of the information is highly classified.

To get at the point you were making, to the best of my knowledge there is no intent on the part of the Air Force to keep within their own bosom the facts generated by Rand if they have any horizontal application to others.

Mr. MCCORMACK. Is there an exchange of information by the several branches of the Armed Forces?

Mr. GARDNER. This kind of information, or general information?

Mr. MCCORMACK. This kind of information.

Mr. GARDNER. The most automatic means is the Assistant Secretary of Defense for Research and Development, Mr. Quarles' office, and coordinating committees within those offices. There is constant communication, however, between the various military members in the Pentagon and an exchange of the information that they get. This has been quite a surprising thing to me since I have been over there in the last year and a half.

This is not to say that there is a complete exchange, but I think where there is a need to know I have never had any trouble getting information from the Army or the Navy.

Mr. RIEHLMAN. I think, Mr. Secretary, what the committee would be interested in knowing is who makes the determination on what should be passed on in the way of information to the other services. Who is in a position to judge whether they should know, and who makes that determination as to what the other services should have in the way of information that Rand is developing?

Mr. GARDNER. I will have to give you a long answer to a rather straightforward question.

Much of the information has no application to the other services proper.

Mr. RIEHLMAN. Now let us take one specific case. I do not want to interrupt you on this.

Mr. GARDNER. Fine.

Mr. RIEHLMAN. Take one specific case. Suppose Rand was working on and putting down on paper a project dealing with guided missiles.

Mr. GARDNER. Right.

Mr. RIEHLMAN. We know that the Army and the Navy are both in the guided missiles field.

Mr. GARDNER. Correct.

Mr. RIEHLMAN. Suppose Rand comes up with a new idea or a new principle they want to follow in the developing of a guided missile, and they think they really have something on paper that is very advantageous to the Air Force. Here we have the Navy and the Army doing the very same thing. Is there someone in a position to say, "Here is what we have on the paper. We want you people on the other side to come in, sit down with us, take a look at this, and take whatever you can that is going to be of value to your projects; to see which 1 of the 3 services is farther ahead and pick this up and go forward with it."

Is there anyone who can coordinate that effort? I suppose that is up at Dr. Quarles' level eventually, but what I am interested in and what I think the committee is interested in is what goes on down in Rand and whether or not some of that information can get out to some of the other services.

Mr. GARDNER. The exchange of studies—and that is what we are talking about now——

Mr. RIEHLMAN. That is right.

Mr. GARDNER. And the knowledge that the studies have existence and the knowledge of what is contained in the studies is made available to the other services through the coordinating committees.

I am very sorry I cannot give you a good answer—and I will supply the answer if I may look into it—to the other question of whether or not all the studies that might have a bearing on guided missiles are brought to the attention of the coordinating committee. For example, Rand might draw some conclusions on guided missiles that might conceivably not get there. I would have to find that out specifically.

Mr. RIEHLMAN. I think it would be helpful to our committee.

Mr. GARDNER. We will supply a statement on this.

Mr. RIEHLMAN. On how information is passed from one of the services to the other, because this is just one big family, as I see it.

Mr. GARDNER. Right.

Mr. RIEHLMAN. If we have something on one side that can be helpful to the other I think it should have coordination at more than just the top level.

Mr. GARDNER. Right.

Mr. RIEHLMAN. So that we can get the story across to the other services, to take advantage of.

(The information is as follows:)

DISSEMINATION OF RAND INFORMATION

Air Force Headquarters through Rand maintains an index (revised monthly) of all Rand studies. Copies of this index are distributed to the Army, Navy, and other governmental agencies such as the State Department and CIA. The indexes are normally kept by these agencies in their technical libraries in order that maximum use may be made of them.

In addition to providing other Government agencies indexes of Rand publications, the Air Force distributes on a semiautomatic basis copies of all project Rand technical publications to interested officers (on a "need to know" basis) in each of the three services. For instances, the Chief, Bureau of Aeronautics, Department of the Navy, automatically receives copies of all technical studies concerning aircraft, missiles, electronics, radar, and communications. An example

within the Army is the Assistant Chief of Staff, G–4, who receives copies of all technical publications on aircraft, missiles, special weapons, electronics, human factors, and economics. The Assistant Secretary of Defense (Research and Development) automatically receives copies of all project Rand technical studies.

Mr. GARDNER. There is another device for getting information across in the area of guided missiles. As you are aware, I headed this committee, which was a rather dramatic example to me of the willingness at the technical level in the three services to collaborate very openly and criticize each other's programs. At various sessions we had they were not noted for their tenderness. We were rather brutally frank with each other.

Colonel Johnson participated in them and he will testify, I think, that all the military members were anxious for free exchange.

This was the sixth major technical review that had been made of the guided missiles program, in addition to the constant monitoring of the program by the Assistant Secretary of Defense, the Coordinating Committee, the Technical Panel on Guided Missiles and Mr. Keller's shop.

So there are a lot of forces at work other than simply procedural forces, which cause a rather complete exchange of technical information.

You might be interested to know that we are prevented by law from a complete exchange on the part of our contractors. One of our conclusions was that it would be very profitable for the Government, since most of the guided missiles contracts are some sort of a cost-plus-fixed-fee arrangement, if the various technical people in the contractors' plants could visit other plants and profit by the experience and knowledge and technical progress that was being made in a different organization. We have now, for 5 months, been attempting to set this up, but there are laws on the books, antitrust laws specifically, which make it extremely difficult, unless there is some change in them—if not impossible—for us to cause an exchange of information at our contractor level so that, for example, the Air Force people, the Air Force contractor at the "Falcon" plant, might take his technical people and visit the Navy "Sparrow" plant and benefit from another organization working on a very similar problem. We cannot do this at the present time. We are, however, making efforts to do it.

Mr. MCCORMACK. Why can you not? You mention laws. What stops you from doing it?

Mr. GARDNER. The antitrust laws. The counsel of the Defense Department had to refer it to the Department of Justice. They will not permit such things unless they are very carefully set up and worded and so on.

Right now in the Defense Department we are attempting to solve this little legal problem so that we can bring about more coordination.

Mr. MCCORMACK. You mean in connection with national defense the antitrust laws stare you in the face?

Mr. GARDNER. That is right, sir.

Mr. MCCORMACK. How does that come into the picture, Mr. Secretary?

Mr. GARDNER. We were discussing complete interchange of information between services.

Mr. MCCORMACK. I know about this. I mean, how does it come into the picture to stop you?

Mr. GARDNER. Well, Colonel Johnson is the Air Force member of the Board that attempted to solve this. Would you try to answer that question, Colonel?

Colonel JOHNSON. Sir, I believe it would be well to correct an impression that might be erroneously gathered here. One is that there is a distribution of technical reports between contractors subject to a distribution list monitored by Mr. Quarles' Coordinating Committee on Guided Missiles. It has his own representation, plus each of the services.

In the actual technical reports on progress, test results, development progress as they proceed, those are exchanged on an automatic distribution list between contractors.

The specific thing Mr. Gardner has reference to is that as we get over into the production side of those missiles which are now entering production, it became apparent during our tour of the plants——

Mr. MCCORMACK. Became apparent during the what, Colonel?

Colonel JOHNSON. Our tour of the various plants where the guided missiles were in various stages of production that it would accrue a benefit to the United States if, for example, as Mr. Gardner said, the top management level of Convair were able to go to the Hughes production plant at Tucson and look at and discuss the particular manufacturing. I think in the Hughes plant their particular thing is a quality control procedure which could have been applied across the board to the advantage of the entire Defense Department, we felt.

When we proceeded to try to set up such a thing we ran afoul of the fact that this is contrary to provisions of the antitrust law.

We now have a committee composed of the general counsels of the three services, plus the General Counsel of the Department of Defense, and service representation, to carry this thing through with the Department of Justice so that we can, without violating the antitrust laws, accomplish this end.

I do not know whether I have made myself clear that there is a difference between the distribution of technical reports and bringing the people around to see things on the spot, apparently, in the eyes of the antitrust laws.

Mr. BALWAN. What recommendations are you making, or is that just being studied now?

Colonel JOHNSON. We are urging that this be brought about.

Mr. GARDNER. We are trying to do it.

Mr. BALWAN. The problem is definitively stated right now?

Mr. GARDNER. Correct. It is a legal problem.

Mr. RIEHLMAN. Can it be solved without legislation?

Mr. GARDNER. It is not known yet. They are attempting to solve it. They have had a number of meetings on it.

When you get into the antitrust business, it turns out to be pretty complicated.

Mr. COTTER. Do the agencies of the Government have to be cognizant of the antitrust laws?

Mr. GARDNER. No, but their contractors do.

Mr. REIHLMAN. It is getting pretty complicated for me.

Mr. COTTER. It seems to me to be fighting windmills.

Mr. MCCORMACK. How important to the national interest is this particular question and its solution?

Mr. GARDNER. I would not say it is transcendentally important.

Mr. McCormack. I am not talking about it being transcendental. It is all a part of the picture, Mr. Secretary. We are all interested in the national interest of our country.

Mr. Gardner. We are getting along with it at the present time and the guided missiles program is progressing. It would progress faster, in my opinion, and we would solve our problems more easily if we could have a free interchange of information between the contractors.

Mr. McCormack. It is important, then.

Mr. Gardner. It is important and it would be helpful.

Mr. McCormack. It would not only have an effect on the maximum results being obtained, but probably would affect the reasonable minimum expense.

Mr. Gardner. It should save cost. That is the point we are interested in, as well as the speed with which the development is made.

Mr. McCormack. We are all interested in that. As far as I am concerned, I am more primarily interested in the national interest. If I am going to err I would rather have error made on the side of security than on the side of insecurity. That is my personal viewpoint.

Mr. Gardner. I favor that viewpoint.

Mr. McCormack. Economy within strength.

Mr. Riehlman. Are there any other questions on that point?

Mr. Gardner. I might say, sir, there is an entity which is set up for the specific purpose of distributing technical reports. It is known as ASTIA. ASTIA, the Armed Services Technical Information Agency.

General McCormack has recently studied ASTIA. It is an organization which our Air Research and Development Command has been directed by the Secretary of Defense to manage. I wonder if you could comment on the kind of technical information job that ASTIA does, General.

Mr. McCormack. Might I ask here: The counsel of the various services and the committee which the colonel referred to are taking up that matter involving the antitrust laws with the Department of Justice. Have you any idea as to when it might be resolved? I am not confining you to a day or any particular time, but just an approximate idea.

Mr. Gardner. Colonel, do you have any feel for it?

Colonel Johnson. No, sir; all I have been able to do is to get an impression, Mr. Chairman. They are attempting to get an informal opinion from the Attorney General, without the necessity of getting a complete formal opinion, which appears to be quite a time-consuming thing.

Mr. McCormack. The purpose I had in mind was to keep the committee and the subcommittee informed.

Mr. Riehlman. I wonder, Mr. McCormack, if you would yield at this time. Why would it not be proper for the committee to have a statement of the exact problem they are confronted with? Then we would have it in the record and we would know then exactly what they are confronted with. Maybe, if we finally get the decision from the Department of Justice, the subcommittee, having previous knowledge of the problem, might be in a position to be helpful.

Mr. Gardner. We would be happy to supply that, sir.

Mr. Riehlman. Good.

(The information is as follows:)

STATUS OF EXCHANGE OF RESEARCH AND DEVELOPMENT INFORMATION AMONG GUIDED MISSILES CONTRACTORS

On October 12, 1953, Mr. Trevor Gardner reported to Secretary Talbott that he had taken action within the Department of the Air Force to provide for a free interchange of information on a top-management level of the guided missile efforts of the three military services.

All three services proceeded to implement this idea until the dispatch of letters from the services to contractors was about to take place. On November 12, 1953, the Staff Judge Advocate at the Air Materiel Command expressed the opinion that the proposal presented opportunity for violation of the antitrust laws and advised getting at least informal clearance from the Office of the Attorney General.

During the period November 25 to December 17, 1953, the problem was reviewed at various levels in the Department of Defense, and the services were asked to suspend action pending a statement from the Department of Justice. On February 25, 1954, the Air Force General Counsel informed Mr. Gardner that the Department of Justice looked upon the proposal with disfavor.

On June 3, 1954, at the meeting of the departmental procurement secretaries with the Assistant Secretary of Defense (Supply and Logistics) the proposal was discussed. In cooperation with representatives of the three services, the Department of Defense General Counsel was asked to develop an effective committee charter and to obtain Justice Department clearance. The objective of the committee will be to increase efficiency, reduce costs, and accelerate production through improvement in production techniques, quality control and other managerial aspects of the guided missile program.

Mr. COTTER. Does the problem arise because one contractor objects to the other contractor?

Mr. GARDNER. No; the contractors are eager for this. The services are eager for it.

Mr. COTTER. If the service directs one contractor to go over to another contractor's plant and the other contractor does not object, where are the antitrust laws involved? The contractor has authority from the United States.

Mr. GARDNER. I am not a lawyer, so I cannot answer your question.

Mr. RIEHLMAN. I say, Mr. Counsel, I think probably we will just go around in circles until we get a statement of the exact problem they are confronted with. It may be we can get our legal minds together and resolve the matter.

Mr. GARDNER. Fine. General McCormack, could you comment just briefly on ASTIA and how the organization distributes technical information? This is Gen. James McCormack.

General MCCORMACK. May I move around here, Mr. Chairman?

Mr. RIEHLMAN. If you would let me interrupt you, I should like to have you meet another General McCormack, Congressman McCormack here. Also, Mr. McCormack, you have not had the opportunity to meet the Secretary, Mr. Gardner, who is here testifying this morning.

Mr. MCCORMACK. How do you do, Mr. Secretary.

General MCCORMACK. The question has to do with the Armed Services Technical Information Agency, which is the principal instrument of the Department of Defense for the interchange of documents, technical documents in being. It was established—I do not recall the exact date—during the period when General Marshall was Secretary of Defense, to combine the separate officers having that function in the various technical services of the Army and in the Navy and in the Air Force.

The Air Force had only one. It was called the Central Air Documents Office. It was built in large part around the captured German documents of Air Force interest. It went under various names in

the other services—in the Ordnance and Engineers and Signal Corps and ONR and so forth.

The two principal physical installations which were retained, and which we are still in the process of trying to consolidate, were those run by the Office of Naval Research, which was being done under contract, to use the word loosely, by the Library of Congress for the ONR; and the Central Air Documents Office of the Air Force, which is located at Wright Field.

Built around those two physical locations we have been in the intervening years pulling in the documents from the various technical services.

You can understand it is quite a task in the Ordnance Corps of the Army, for instance, out of all their laboratories and test installations, to get together all of the documents, recatalog them, so that they can fit into a common system, and consolidate the whole lot of them. In fact, they are still coming in from some of the technical services.

ASTIA is furnished information by the three services and is authorized to pick up documents elsewhere, as they may find them, that would be of interest, such as the German documents that came in after the war.

Certain categories of documents are excluded from the mandatory submission to ASTIA. For example, ASTIA carries no "top secret" documents. It levels off at "secret." Also, this is true: ASTIA handles no documents containing atomic restricted information, restricted under law by the Atomic Energy Commission. A few other special categories having to do with operational plans are also excluded.

In general information of a "secret" category and below is turned in to ASTIA and on a common cataloging system is available to all 3 services; on a distribution list, approved by the 3 services, to their contractors. The objective, of course, is to further the interchange of information and to get a better job done—to get the work done more quickly and to avoid buying the same research and development twice; to get it done more cheaply, and so on.

Then way at the other end of the scales, of course, is security in terms of secrecy of information, where the rules and regulations are basically intended to protect the document. This is the balance against the other objective of research and development, which is also desirable. The very careful working out of this mechanism has been a major chore. I would say we are in pretty good shape by now.

One of the problems that has dogged the organization as it has grown up and matured is, of course, that of still being located physically in two places. Half of the operation is in Washington behind this building, and the other half out in Dayton. Functionally we have integrated the two operations. Physically there is quite a bit of waste motion because the two exist. We are striving to combine the two, and in order to save the very valuable and elite nucleus which the Library of Congress has built we are trying to consolidate in the Washington area. The governmental pressures, of course, are in the other way, to decentralize out of Washington.

The other problem that has caused the greatest difficulty, I would say, other than working out security arrangements, is that as the list of titles has become bigger the contractors as well as the Government agencies are better aware than they once were of what

documents actually do exist, what work has been done and been reported, and as the services got a little better the demands for documents have gone up.

There is still a lag in the quality of service, because every month the demands for the documents, the legitimate requests for them, are still greater than our ability to furnish them. The major effort over the past few months has been to reduce the backlog of unfilled orders resulting from this, and we have gotten the backlog from what was apparently something like 40,000 requests—this amounting to some 8 weeks of time—now down to a couple of weeks. Some day we will have it down to a week, and that is about perfect. It will be working better in a few years than it is now.

Mr. GARDNER. Mr. Chairman, there is a device under our own Air Research and Development Command management which we manage under the direction of the Department of Defense which I would like to mention.

Mr. LANTAFF. May I ask a question at this point?

Mr. RIEHLMAN. Yes, sir.

Mr. LANTAFF. Do I understand ASTIA serves as the library and distribution agency for documents classified secret and below?

General MCCORMACK. Yes, sir.

Mr. LANTAFF. What arrangement is made for comparable distribution of top secret?

General MCCORMACK. That is handled directly between the services on a specific request and a specific interchange of information arrangement. ASTIA is a big mail-order house. The rest of it is done by special arrangement.

Mr. LANTAFF. Why is it not feasible to have a comparable agency for the dissemination of this technical information for top secret? It would seem to me that the biggest need for distribution would be in the field of top secret. That to me would be information which was of such value to the security of the country that it would carry a top secret classification, and, therefore, would be in most need by other people in that field of research or development.

Mr. GARDNER. Well, as General McCormack pointed out, the questions of distribution and security are diametrically opposed.

Mr. LANTAFF. Right.

Mr. GARDNER. A top secret will remain a top secret better if only one person knows that secret.

Mr. LANTAFF. That is right.

Mr. GARDNER. Every additional person who knows the secret makes it become less and less top.

Mr. LANTAFF. Correct.

Mr. GARDNER. This is the horns of the dilemma you find yourself on.

Colonel Johnston has informed me of something that I was not completely sure of, which I said I would supply. On RAND there is an automatic distribution list for reports as to categories. This does include the three services, as I stated. In addition—and this is the point I did not make—there is a distribution of a periodical index of all the reports to the three services; that is, the RAND reports. If a need to know is demonstrated by the service or by the requester, regardless of whether in the Army, Air Force or Navy, he gets that report. This is now addressed just to the RAND situation.

Mr. BALWAN. How do they know the report exists?

Mr. GARDNER. By receiving a distribution list of all reports that have been distributed.

Mr. LANTAFF. Of course, your distribution list of top secret information would be classified top secret, too, would it not?

Mr. GARDNER. Not necessarily. This is again a weakness of this kind of thing, but you cannot have quite a perfect system. The title of a report most frequently is not classified top secret. It is the contents of the report that are classified.

Mr. LANTAFF. I can well appreciate the dilemma you are in between having a top secret and as wide a distribution as possible. Oftentimes this committee in past years has run into a tendency on the part of some of the services to withhold dissemination or distribution by resorting to the classification of top secret. That is the point I was getting at.

Where a very nice setup of ASTIA is in the business of distributing information which is pretty generally available anyhow, is all of the important information that would need to be cross-serviced, so to speak, to prevent duplication in this technical effort, actually being withheld under security classifications?

Mr. GARDNER. There are an awful lot of management people in the technical business who do not have a need to know about a new technical fact that is top secret. The technical people at the working level generally know each other's top secrets pretty completely, in my experience.

Mr. LANTAFF. But, nevertheless, they would not be authorized to divulge that without authority to do so?

Mr. GARDNER. That is true, but if they are requesting information and have a need to know they can get it.

I cannot speak generally because in my kind of a job, while it is a fairly broad job, I get a narrow view. But speaking for the Air Force and speaking just from my own experience, I have not asked for any top secret documents from any of the services or from the Secretary of Defense or even from the JCS that I have not been able to get and get quickly.

Mr. LANTAFF. In other words, you think that you have indexes or indices or catalogs available to you from the Army and the Navy and the other agencies engaged in technical research which will enable you to know what information is available that you can get on a need-to-know basis?

Mr. GARDNER. Again, I am speaking now of my own personal information. I have seen lists of certain top secret papers. Whether I have seen lists of all of the top secret papers in the Pentagon or not that bear on matters technical—I am pretty sure I have not. Again here we come back to this top secret business. The very fact that it has the top secret classification on it tends to keep it on a need-to-know basis.

Mr. LANTAFF. Of course, the index itself, by virtue of a descriptive title, could be classified top secret so that you could not even see the index, other than on a need-to-know basis.

Mr. GARDNER. I think we are on the verge or on the outskirts of one of the real fundamental problems about whether you make more progress with higher security or whether you make more progress

with low security. I am talking about progress relative to our enemy, now.

Mr. LANTAFF. Right.

Mr. GARDNER. Because that is the only yardstick we have in this business.

Mr. LANTAFF. Just one final question. Who in the Pentagon is responsible for making the determination of security vis-a-vis dissemination?

Mr. GARDNER. The originating office has the responsibility.

Mr. LANTAFF. There is no Pentagon or defense agency as such which has the power to overrule the originating agency in connection with its own classification of technical information?

Mr. GARDNER. I would like to supply the answer to that; or, if one of our people here knows he can speak up. I do not know the answer to that, sir.

This is General Ben Kelsey.

General KELSEY. Sir, in connection with this there is an inference that these things develop automatically. They do not. They are the result of programs which have been coordinated and supported. The budget programs, for instance, are coordinated. We know the other services activities. They know ours.

These programs result in reports and work which is top secret. The existence of this program is known to the other services, which has indexes which are supplied quite frequently. People who are interested in that can follow it and get the reports. These things are not generated in the abstract.

Mr. LANTAFF. Of course, the fact that there is a project is not of itself classified.

General KELSEY. That is right.

Mr. LANTAFF. But the progress within that project is all classified top secret.

General KELSEY. That is correct.

Mr. LANTAFF. But that is the information needed by the other scientists and the other services if we are to prevent duplication of effort.

General KELSEY. This is a service responsibility, to insure that they keep track of the other activities in the areas in which they are also working.

Mr. LANTAFF. That is exactly the point I am getting at. Do you think it would expedite the technical effort if there were an agency within the Defense Establishment which had the responsibility of determining whether or not distribution or security was the primary classification with reference to certain types of information?

General KELSEY. I think not. I think it would be completely snowed under. These activities go through such a wide field that you have to depend upon the individuals who are working in these very broadly distributed fields to keep aware of their interest in the same fields and to make sure that the other people who are working on a similar field be kept advised of their progress.

Mr. LANTAFF. Except that under your security classifications the scientist that you might tell in the Navy certain information, even if he knew some Army scientist was working on the very same proposal with reference to a missile, would be prohibited from disseminating that information to him; would he not?

General KELSEY. This gets back to what I introduced at the beginning. These result from programs. The thing is not self-generated. The programs are going and are coordinated, and the expenditures, and so forth, also. Status reports on progress have to be made. There is no change in emphasis or elimination or deletion of a program which can go on without coordination with the other services.

Mr. GARDNER. Mr. Lantaff, could I make two points that I have been thinking about as General Kelsey has been talking?

Mr. LANTAFF. Surely.

Mr. GARDNER. One is that we do not like top secret. When someone classifies something top secret there is a lot of resistance to it, because it makes it hard to handle and everybody's office gets more vulnerable. There is an automatic tendency away from getting documents classified top secret.

Mr. LANTAFF. Too many filing cabinets?

Mr. GARDNER. Yes, and too much personal risk and so on; too much cost in handling. The top-secret documents that you see as a run of the mine generally relate to war plans or troop deployment or Atomic Energy Commission matters.

Mr. LANTAFF. Yes.

Mr. GARDNER. I have been sitting here trying to think about the guided-missiles field, just what technical facts I can think of in the guided-missile field which are classified top secret. There is a lot of stuff in the field classified top secret but it is not technical information. As I was sitting here thinking about it I was realizing that we do not have a large volume of top secret technical information, which is another partial answer to your question.

Mr. RIEHLMAN. Would you yield at that point?

Mr. LANTAFF. That is all I have.

Mr. RIEHLMAN. I wonder, Mr. Secretary, if we could have this information: This morning in your opening remarks you spoke of two developments; one in radar and the other in this plating. How are they classified in your Department?

Mr. GARDNER. No higher than secret.

Mr. RIEHLMAN. No higher than secret. Would the other services be able to avail themselves of that information that you have developed with respect to radar?

Mr. GARDNER. When they appear in a report, which they will, that is correct.

Mr. LANTAFF. That will be through ASTIA?

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Mr. RIEHLMAN. Of course, if they were trying in one field of their activity to develop this same program and project, it could be canceled, if you had accomplished what you wanted to in this field; is that not true?

Mr. GARDNER. Right.

Mr. RIEHLMAN. Would that be brought about?

Mr. GARDNER. That would be brought about; yes, sir.

(Discussion off the record.)

Mr. RIEHLMAN. Are there any other questions? All right, Mr. Secretary, we can proceed.

Mr. GARDNER. If you recall, I have said that we developed these development planning objectives as the basis for program guidance. In addition, our Air Staff gets out a large document which contains detailed program guidance not only of the weapons systems but of the components and state of the art developments. This is a document of about 150 pages. It is well thought out. It is coordinated through our Air Staff and it is sent down to the commands and centers as basic program guidance for the entire program.

We have as a management control tool a program which I have a sample of here, which contains our program broken down by line item, very much as we defend these items on the Hill.

My first concern was: "Is this program right?"

I might say on this point, if a mechanical engineer goes through our program he will want more emphasis on mechanical engineering. If an electronics engineer goes through our program he will want more emphasis on electronics. So no program can ever be right by everybody's definition, but this is as right as we can make it.

No major change can be made in this program without the approval of our headquarters and without the knowledge and approval of my office. Se we have control of the initiation of projects and the control of the program, which is at the Secretary of the Air Force and Chief of Staff level.

I believe that this gives us a surprising amount of knowledge and control of our total program. Such a control device injects delays. If we could permit people in the field to change programs and modify them at will it certainly would be faster, but I think we would then be guilty of criticism that we could not keep tight enough rein on what was going on, and worthless projects could be initiated and duplicate projects could get started without our knowledge.

But we do have this as a basic management control tool. It keys directly into the development planning objectives. This is not to say that every item in here is not something that is called out for in a development planning objective, because there are other objectives than the objectives for just weapons systems.

I wanted to mention, Mr. Chairman, a device we have which I consider to be quite good which results in the program and in the Secretary of Air Force Office having a day-to-day knowledge of the program and program changes. We brought some charts along to show you the funding.

You will see that our 1955 budget is $431 million. This is the budget as we defend it before "The Hill".

* * * * * * *

On this next chart we have taken that same $431 million and arranged it showing you what we plan for 1955, what 1954 and 1953 were, in each of these categories.

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I will not bore you by going through them, but we can supply these charts for the record. We would be glad to answer any questions you have on them.

Mr. RIEHLMAN. Are there any questions on the charts? If not, if you have copies of them we will insert them in the record.

Mr. GARDNER. All right.

(The charts are as follows:)

Air Force research and development costs

	Fiscal years		
	1953	1954	1955
Direct costs: P-600 appropriation [1]	$525,000,000	$440,000,000	$431,000,000
Indirect costs:			
Service test (including guided missiles), estimated	(2)	296,259,000	304,326,000
Nonstandard mission support	(2)	27,269,000	46,400,000
Research and test support (P-460)	(2)	78,745,000	80,000,000
Command administration (P-481)	(2)	3,089,000	3,739,000
Military personnel pay and allowances, estimated	(2)	77,738,000	74,750,000
Acquisition and construction of real property	(2)	39,123,000	115,865,000
Estimated total indirect costs		522,223,000	625,080,000
Estimated total direct and indirect costs [3]		962,223,000	1,056,080,000

[1] Fiscal year 1955 figure represents the request in the President's budget. The House recommendation to the Senate is $409,450,000.
[2] Data not readily available.
[3] See attachment.

ATTACHMENT

1. The tabulation presented excludes:
(*a*) The cost of standard items of equipment and material which are issued to the commands engaged in research and development.
(*b*) The cost of complete aircraft which are required for test purposes.
(*c*) Costs associated with the staff of the Deputy Chief of Staff/Development, Headquarters USAF.
2. Approximately $1.3 to $1.5 billion would be required annually to cover all costs associated with research and development if we were to operate under a "performance budget" concept.

Mr. GARDNER. That completes my comments on the scope of the Air Force research and development program, including some comments on how we manage that scope.

Mr. RIEHLMAN. Yes.

Mr. GARDNER. I would like now to address myself to your second question. This now goes back on the other kind of a record.

Mr. RIEHLMAN. That is right.

(Discussion off the record.)

Mr. GARDNER. You asked:

The extent of coordination of all the technical service research and development programs at the levels of the Chief of Staff and the Secretary.

In reading Dr. Quarles' statement I find that he has covered a number of points, but I will read my statement. It will be slightly redundant as far as what was said yesterday.

In order to best illustrate this point, Mr. Chairman, I will refer you to this chart (chart, enclosure 1). This chart attempts to depict rather simply the organization of the research and development complex of, first, the Department of Defense and, second, the Air Force as it fits into the picture. I believe that this chart, a copy of which has been furnished to you, fulfills your request in item 3 of your letter. Starting at the top, we have the Secretary of Defense. He has three assistants, only one of which is depicted here. This is the Assistant Secretary of Defense for Research and Development, who is the Honorable Donald A. Quarles. Dr. Quarles' organization embraces a number of coordinating committees, covering the entire spectrum of research and development in the three services. These committees are organized with appropriate representation from each

of the three services and are divided functionally as to their areas of responsibility.

I might mention here that General Putt, the Deputy Chief of Staff, Development, or myself, are the people who determine who represents the Air Force on these coordinating committees.

By that I mean there is, for example, a Coordinating Committee on Guided Missiles and another Coordinating Committee on Piloted Aircraft. In addition to the coordinating committees, Dr. Quarles has a research and development Policy Council which is comprised of not only his own top staff, but the responsible staff member of each of the separate services, together with the responsible Secretary-level individual of each service. For example, I am a member of this council. Each research and development project is not only coordinated prior to its inception by one or more of the coordinating committees, but is periodically reviewed as progress ensues. By this medium, duplication tends to be avoided except in those areas where the solution of the problem presented is so difficult as to warrant a multiple approach; an interchange of technical information is achieved and availability of test and evaluation data is provided.

Mr. RIEHLMAN. Are there any questions on that point?

Mr. MCCORMACK. Do you have an Assistant Secretary of Air for Research and Development?

Mr. GARDNER. We do not. My duties read as though I were a statutory appointee, the same language as is used for other Assistant Secretaries in the Air Force, and my function is Assistant Secretary, but we do not have such a slot in the Air Force as you mention.

Mr. MCCORMACK. Do you care to express your opinion as to whether or not there should be, or is that a matter of policy that you might not want to discuss?

Mr. GARDNER. I would like to make clear what I say does not relate to whether I am in the job or not.

Mr. MCCORMACK. Yes.

Mr. GARDNER. I think the Air Force should have an Assistant Secretary for Research and Development, but my boss decides those things, along with Mr. Wilson.

Mr. MCCORMACK. I have a bill in to that effect for all branches.

Mr. GARDNER. I am aware of that.

3. "Organization charts which illustrate lines of responsibility and authority."

The next position on the chart (enclosure 1), Mr. Chairman, is the Secretary of the Air Force, the Honorable Mr. Talbott. I function as his specific assistant for research and development material, and it is my responsibility to him to review the Air Force research and development program as to its adequacy, conduct, and to determine, insofar as possible, that the best management procedures are employed. Directly in the command line is the Chief of Staff of the Air Force, General Twining. The Chief of Staff has a permanent advisory body of scientific civilian consultants who represent the highest technical and scientific competence the country can offer in the various fields of Air Force interest.

I might add, and those that we can recruit. We cannot always recruit all the best technical talent and this sometimes presents a problem.

Mr. BALWAN. Who heads up the permanent advisory body?

Mr. GARDNER. Dr. Von Karmen.

Mr. BALWAN. Do you have a list of these consultants that you could provide the committee?

Mr. GARDNER. We will be glad to. They include a large faction of the top names of American scientists.

This group is described on the organization chart as the Scientific Advisory Board. The present Air Force organization for accomplishing its research and development mission resulted from an exhaustive study and survey made by members of this Board and the then Chief Scientist of the Air Force, Dr. Louis N. Ridenour, in September 1949. The Board periodically reviews the technical adequacy of our research and development program and submits its recommendations directly to the Chief of Staff. In addition this group is available to the Deputy Chief of Staff, Development, and to the Air Research and Development Command for assistance and advice in the solution of scientific and technical problems. The Chief of Staff has reporting directly to him a Chief Scientist who is a civilian from the scientific community who accepts a full-time assignment for 1 year to advise the Chief of Staff on scientific matters, including the organization and management. The current Chief Scientist, presently on leave from his position at the University of Illinois, is Dr. Chalmers W. Sherwin, a leader in the field of electronics research.

Mr. BALWAN. How many have you had in the past?

Mr. GARDNER. Dr. Louis Ridenour, Dr. Dave Griggs and Dr. Yvon Getting.

Mr. BALWAN. They were advisers to the Chief of Staff?

Mr. GARDNER. Right. They function as Chief Scientists reporting directly to the Chief of Staff in an advisory capacity.

Mr. BALWAN. That is in addition to the scientists on the Scientific Board?

Mr. GARDNER. Yes. This is a full-time person, whereas the Scientific Advisory Board meets periodically as a part-time consultant board.

The Air Force organization, therefore, reflects an emphasis on quality through the establishment of a Scientific Advisory Board to the Chief of Staff, the employment of a full-time civilian scientist in the Chief of Staff's office, and by the creation of the position of Deputy Chief of Staff, Development.

I may say further, at the civilian level we reflect our interest in quality by having my job as Special Assistant, Research and Development, reporting to the Secretary with the same duties as an Assisant Secretary. Neither of the other services has this sort of a civilian arrangement.

General Twining's Deputy Chief of Staff, Development, is Lt. Gen. Donald L. Putt. General Putt was Commander of the Air Force Research and Development Command. At the operating level of the Air Staff, and specifically under General Putt are two Directorates. These are the Directorate of Requirements and the Directorate of Research and Development, Brig. Gen. George E. Price occupies the former position while Maj. Gen. N. Yates occupies the latter. It is the responsibility of the Headquarters USAF to provide general policy guidance on a broad program basis to insure that the Air Force research and development program is adequate to

fulfill its requirements and that the program achieved is commensurate with the effort involved.

I would like to reemphasize that. That is our payoff line, that the progress achieved is commensurate with the effort involved.

Further, it is the responsibility of the Air Force Staff to provide the coordination of the service research and development program in the various coordinating committees of the Office of the Assistant Secretary of Defense for Research and Development.

Mr. McCormack. If there is a conflict between the military and the scientists, who resolves it?

Mr. Gardner. What sort of conflict do you mean?

Mr. McCormack. A conflict on some research.

Mr. Gardner. In the case of conflict on one of the uses of a weapon that has been developed, that is a military matter.

Mr. McCormack. Or instituting a new discovery study?

Mr. Gardner. The normal practice is that this would first be resolved by the Deputy Chief of Staff, Development, and if I did not like the conclusion of the Deputy Chief of Staff, Development, that he came up with, I could overrule him with the support of the Secretary. As a normal method operation it is very difficult to get, with all the demands on their time, top scientists to work for us because so many other people want the same bodies to work for them. When we are lucky enough to get the bodies and the brains working for us, we are not very reluctant to use their good ideas.

Not all of their ideas, strangely enough, are good, and they have to be sorted out because we have a military operation to run. We have had a recent example of some scientific conclusions on a program that differed from some of the military opinions. In that case the Secretary, the Chief of Staff and myself, and the Deputy Chief of Staff, Development, sat down and discussed what the difference was and we ruled in favor of accepting the conclusions of the scientific group. That does not happen very often. The most normal thing is to grab at the new ideas as they come out.

Mr. Cotter. Where does the responsibility lie in this organization to determine when you have something you should go into production with?

Mr. Gardner. That is the most difficult question of all, and the other side of this chart will show the Deputy Chief of Staff, Materiel. With regard to the decision to go into production, there are two sets of circumstances. One is a rational situation with no war, no Korea, and the other is a somewhat irrational situation, where one is willing to accept risks on development and make an early production decision.

In the rational situation, the Deputy Chief of Staff, Development, when he has a satisfactory prototype, passes the ball to the Deputy Chief of Staff, Materiel, and the decision to produce is made by the Deputy Chief of Staff, Materiel.

Mr. Cotter. The know-how is over on this side of the judgment, is it not?

Mr. Gardner. The judgment as to whether the product is ready to be produced is the responsibility of the Deputy Chief of Staff, Development. He has a lot of assistance in this judgment because the people in the materiel business also have some good engineering judgment, and there is a joint project office set up down at the Wright Air Development Center, and Air Materiel Command, for resolving

just these kinds of questions at the operating level, so that the only differences of opinion on when you should produce that find their way up are when there are real differences on important matters.

Mr. COTTER. Is it a consensus of opinion between Deputy Chief of Staff, Materiel, and Deputy Chief of Staff, Development?

Mr. GARDNER. It is the decision of Chief of Staff, and he has said in cases where the Deputy Chief of Staff, Development, and the Deputy Chief of Staff, Materiel, disagree, that the Deputy Chief of Staff, Materiel, judgment should prevail.

Mr. BALWAN. Do you have anything equivalent to an application engineering section on the order of what we have in OSRD for resolving these differences?

Mr. GARDNER. No, we do not; and I hope we do not get it. Frankly, I would not know how to reorganize our setup to include right down through the bottom of the organization a reflection of this applications engineering philosophy. We do have groups of people that roughly perform the function that is roughly described by the Applications Engineering Secretary's duties, but I just would not know how to organize the Air Force to do this.

Mr. BALWAN. As I understand the office on the level of the Secretary of Defense, the Assistant Secretary for Applications Engineering is there to curb the enthusiasm of the developers to get their items into production, is that not so?

Mr. GARDNER. I will have to confess it is not too clear to me what the Assistant Secretary for Applications Engineering is there for.

Mr. BALWAN. We do not know, ourselves.

Mr. GARDNER. To proceed down the command line we have the main agency for the execution of our research and development program. This is the Air Research and Development Command with headquarters in Baltimore. Lt. Gen. Thomas S. Power has been just recently designated as the commander of this organization. Directly responsible to the commander of ARDC are the various development centers such as the Wright Air Development Center at Wright-Patterson Air Force Base; the Rome Air Development Center at Rome, N. Y.; the Air Force Armament Center at Eglin Air Force Base; the Cambridge Research Center at Cambridge, Mass., etc. These centers are responsible for the conduct of the Air Force research and development program. The areas of responsibility are functionally divided; for example, the Wright Air Development Center is mostly concerned with the development of major weapons systems such as aircraft and missiles. I believe it is appropriate to explain that the efforts of the personnel of these centers are to a large part directed to the testing and evaluation of the Air Force items which are developed, as I explained before, by civilian industry. It is their job to translate military requirements and characteristics into technical language so that the industry can devise and invent the hardware to fulfill these requirements. They perform numerous other functions which cannot be categorized as research and development, such as the approval of engineering change proposals submitted by industry; the determination of "fixes" on failures encountered in service after the items are out of production, etc. Approximately 15 percent of our research and development program could be described as "in house" research and development. The largest part of this goes for the operation of the various testing laboratories and for the contract operation of our large

scale development facilities, such as the Arnold Engineering Development Center at Tullahoma.

Mr. BALWAN. With respect to the Rome Air Development Center and the Cambridge Research Center, is one strictly a research organization and the other a development center? From the staff's inquiry into the centers there was no such clear line of demarcation.

Mr. GARDNER. I was not in on the naming of these children and General McCormick is more of an expert on that question than I. Could I refer the question to General McCormick?

General MCCORMICK. Cambridge at the beginning of its career was very closely oriented toward research, and that was probably the genesis of the name "research." It is still a fact that Cambridge is still a great deal more clearly oriented toward research, and the results that we expect from them, than is Rome, although I certainly agree with you when you go into a research and development organization at a center the line of demarcation between the two is not too sharp. But the bulk of the product of the Rome Air Development Center is gear, components, and systems. A great deal of the product of Cambridge is papers, and that is one way of distinguishing between development and research.

Mr. BALWAN. I notice that you said further back that your main function is testing. Why do you place so much emphasis on the fact that these operations are primarily operations to test commodities produced by industry?

Mr. GARDNER. We operate the Edwards Air Force Base.

Mr. BALWAN. I understand that.

Mr. GARDNER. That is a testing function purely.

Mr. BALWAN. How about Rome?

Mr. GARDNER. We were not referring too much to the testing function at Rome although there is quite a large testing function there.

Mr. BALWAN. But Cambridge is primarily a testing function?

Mr. GARDNER. A testing function; that is correct. For example, one of the Cambridge missions right not is testing the product of Lincoln, or assisting in testing the product of the Lincoln laboratory * * *.

Mr. BALWAN. Not all of your centers, however, are doing testing of the nature that we have at the Patrick Air Force Base, which is for operational suitability, which requires a large military organization.

Mr. GARDNER. That is correct.

Mr. BALWAN. Am I correct in that?

Mr. GARDNER. The Holloman Air Force Base, Patrick, and Muroc are bases where we are almost exclusively engaged in testing. The Kirtland Air Force Base is a mixture of testing and some research and development and some other missions * * *.

The spectrum of activity in each one of these centers is not purely one thing or the other, but there is quite a lot of testing of industry's product that makes it very largely the main function of some of the laboratories.

Mr. BALWAN. The reason that I asked that question is because it relates to a discussion that we had with Secretary Quarles. That will come up in a later part of this discussion, but I thought that it should come in here also, and that is, when we asked whether a center should have more military control the answer was—if the main mission of a base is to test equipment, we need more military control on the base,

since it might require an airbase there, or something like that, and we will have a lot of military people. If the mission of the base is more on the research side, or the development side, then we can tolerate more civilian control in the operation where our function is not to handle large groups of military people.

I just want to get it straight here as to why we call the main mission of these centers that of testing. It will affect us in our later discussions.

Mr. GARDNER. I would like to make a comment on that very point: How to run a laboratory is an art that has not yet been evolved. In the Office of Scientific Research and Development we had some notably good laboratories and notably poor laboratories, and they were all completely civilian. Some of the military laboratories of this country run by the military are extremely good. Some of them are extremely poor, and I think the goodness or the poorness is not dependent upon whether it is military or civilian as much as it is upon the quality of the individual who has the management responsibility for causing the mission of the laboratory to pull creative effort out of the useful people there.

Mr. BALWAN. The total effort of a research organization which results in outcomes which can be described as good or bad is a difficult thing to appraise here because if OSRD had some scientific organizations which were bad, it can mean the management was bad, or they did not produce anything, and in scientific work many times you do not produce anything, and it is a matter of getting a lot of work out and having these negative findings which are a definite contribution and weeding out things we do not want to get into. Would that not be correct?

Mr. GARDNER. That is correct. It could be either the laboratory is just confused and does not produce and everyone sits around and allows instead of inventing, or it can be simply they invent the things that do not work, or they invent the wrong things, or they come up with negative answers. Frequently negative answers are as useful as positive ones,

Mr. BALWAN. A necessary part of our whole research and development program is to find out things that do not work as well as those that do work.

Mr. GARDNER. Exactly.

Mr. MCCORMACK. Let me ask you this. I notice a similarity in these reports by all of the services. Was this testimony of yours cleared?

Mr. GARDNER. My testimony here was not cleared by anyone. As a matter of fact, I have in my pocket an analysis of the similarity of this report with what Mr. Quarles said, and I was surprised. I saw Mr. Quarles' statement for the first time when I arrived here day before yesterday to testify, and then you changed your plans.

Mr. MCCORMACK. That answers my question. Naturally when you see such a marked similarity you draw an inference. I wanted to get a direct answer rather than to rely on inferences from an apparently established fact. Sometimes inferences are justified, but when the direct evidence is obtained then it removes the justification for drawing certain inferences.

Mr. BALWAN. On that point I think that it might be proper to ask whether the receipt of word from this committee that there would

be these hearings caused the Army, the Navy, and the Air Force to confer with Secretary Quarles on how they should make their presentations.

Mr. GARDNER. This was discussed in the Research and Development Policy Council, the fact that the hearings were going on, what were they about, and the detail of what our reaction was to be to your questions was not discussed. I was not at the meeting, however, but I had no discussions with Mr. Quarles or anyone else, except my own staff about how we would prepare our replies for you. I think that our staff did have discussions with one of Mr. Quarles' assistants on this, but we tried to prepare these as honestly and as factually as we could.

Mr. MCCORMACK. That question was not raised.

Mr. GARDNER. Mr. McCormack, I studied with a friend of mine once for a test in college, and when I got the test I realized because we had studied together we were going to have similar answers and I insisted on sitting on the opposite side of the room from him.

Mr. RIEHLMAN. You may proceed.

Mr. GARDNER. 4. "Any contemplated change in the organization and administration of this program."

The organization and administration of a program of the scope of our Air Force research and development activity necessarily must undergo constant change. While no major organizational or administrative changes are immediately contemplated, we are continually making minor organizational revisions and conducting organizational experiments in an effort to more adequately solve the difficult problems posed by the operation of our complex laboratories and test facilities.

I would like to add to this a few additional remarks, if I may.

Mr. RIEHLMAN. We would appreciate that.

Mr. GARDNER. General McCormick has been the moving spirit in questioning whether we had the right kind of a military-civilian organizational setup in the various laboratories, and specifically whether the military was properly staffed and whether the military organization was the right kind. He has conducted what amounts to organizational experiments which, at some of the centers, I think, would have considerably improved results.

Recently we have had some examinations of the organization and management by a committee that reported to General Cook, Lieutenant General Cook, when he was in the Deputy Chief of Staff, Materiel, job, about 4 months ago, and more recently our Assistant Secretary for Management had his staff make an analysis of the adequacy of the Air Force management, so that whether we are managing and administering the program properly has received a lot of attention.

Mr. RIEHLMAN. Having made these studies, are there any anticipated changes?

Mr. GARDNER. The main kind of changes that can be made are the ones that are already in the bill. The concept of having an Air Research and Development Command, which is not paralleled in the other two services, having all of your research and development in one tile where you can manage it and see it——

Mr. BALWAN. That in itself was a recent development?

Mr. GARDNER. Yes. It was instituted a little over 2 years ago.

In an organization of approximately 40,000 people it takes a while to shake out the management problems and be sure that every person who has large responsibilities is a large person.

From my own experience, the people that we have at the general officer level doing this job are among the most competent managers and technical people in the Air Force. I would not know where to go in the Air Force to improve on General Putt, for example.

Mr. BALWAN. The reason this question was asked is because it created some confusion. When the staff talked with General McCormick and the liaison division, this is what came up: The Air Force, because our hearings were directed to research and development, thought that we meant—are there any changes contemplated in the organization of the research and development program. What the staff was referring to in directing this question to the Air Force was, are there any organization administrative changes contemplated on the order of the Army and Navy reorganization plans which are manifest in the Davies committee report and the Gates committee report, which are for the reorganization of the whole departments, respectively, and which stem from the original Rockefeller committee report, which in turn resulted in Reorganization Plan No. 6, with the added directive by the President asking each of the departments to review their organizations and make recommendations to him.

We were not able to find such a study being made by the Air Force as of last night.

Mr. GARDNER. This question was brought up before coming over here this morning so we might be responsive, and I think what was being referred to as an analysis made by Assistant Secretary for Management, Mr. H. Lee White, in the Air Force, in response to what changes should be made throughout the department to bring it in line with the Rockefeller report.

To the best of my knowledge, it is not planned to make any changes in the Air Force organization unless it were to be to make the special assistant for the research and development job an Assistant Secretary job.

Mr. BALWAN. You have stated your feeling about that, that you would recommend that be done.

Mr. GARDNER. I have so recommended.

Mr. COTTER. There was no equivalent committee report as there was in the other services.

Mr. GARDNER. I am sorry, I cannot answer that question. I worked with Mr. Lee White on a fairly voluminous document which went down to Mr. Wilson sometime ago, but the exact content of the whole document did not concern me since I had the narrow end of the spectrum.

Mr. White's office did conduct this management review of the Air Research and Development Command, and the report is quite encouraging for those of us whose judgment it is that the management of it is in pretty good shape.

Mr. BALWAN. If it turns out that there is such a committee study being made I wonder if we could have a copy of it.

Mr. RIEHLMAN. Yes.

Mr. GARDNER. I will find out when we get back to the Pentagon.

5. "The direct cost of the Air Force research and development program for the fiscal years 1953, 1954, and 1955."

The direct costs have been furnished you as enclosure 2 and they are: 1953, $525 million; 1954, $440 million; 1955, $431 million. The obligations of the 1955 program have not yet begun.

6. "An estimate of the indirect cost allocable to those programs to the extent that this is desirable."

We have listed on enclosure 2 those items chargeable to indirect costs. You will note that we were unable within the time allotted to secure the dollar figures for fiscal year 1953. Reading from this chart, the indirect cost items are: Service test, including guided missiles, which is an estimated figure; nonstandard mission support, which includes such items as commercially available test instruments and like items; research and test support, which would include such items as standard engines used in development airplanes, etc.; command administration; military personnel pay and allowances, which is an estimated figure; and lastly, the acquisition and construction of real property. The total for the indirect costs for the fiscal years 1954 and 1955 are $522 and $625 million, respectively.

I would like again to say this is based upon estimated figures as accurately as we can estimate them.

Several items which are certainly indirect costs are not included for the reason that our costing methods do not permit such a breakout, for example: The cost of complete aircraft which are required for test purposes. These aircraft are procured for other reasons and employed in the development program for the purpose of test support after which they are returned to the appropriate aircraft inventory. A very rough estimate of the total support costs, were we operating under a "performance budget" concept, would be in the neighborhood of $1.3 to $1.5 billion.

Mr. BALWAN. Does that mean at a base such as the Cambridge Research Center, the Hanscom Air Force Base would not be included in the direct cost?

General MCCORMICK. We are including up at Cambridge that part of the operation of Hanscom we can apply directly to the test of Lincoln, or the test of a gadget in an airplane for geophysics. We are applying that to the direct cost.

Mr. BALWAN. How about the cost of just running an Air Force base—all the officers, the commanding officers, the maintenance, and the gasoline for the airplanes?

General MCCORMICK. That is indirect.

Mr. BALWAN. All indirect cost?

General MCCORMICK. Yes.

General MAUDE. In our bookkeeping records in the Air Research and Development Command, we spread out the pay of civilians between those directly engaged in the service of development as opposed to the chap who is sweeping with a broom in the warehouse, and that part of the civilian pay which feeds directly into research and development is carried as a direct cost. The overall air research and development operation for the year includes in our budget figures some $80 million, as I recall the figure, for what is called base maintenance and operation. We carry that as regards bookkeeping as an indirect cost, having pulled out all the things connected with research, development, and the operation of development testing.

Mr. BALWAN. When you come to the Congress and ask them for appropriations to run your research and development, you do not have

to have a specific appropriation to carry out your indirect costs. Those are included in the regular operational budget?

General MAUDE. Yes; identified as the Air Research and Development Command in the budget.

Mr. RIEHLMAN. Mr. Secretary, it is now 12 o'clock and I know that we are going to have some roll calls immediately today on an appropriation bill. I am sorry that we cannot finish your testimony this morning. I understand that we have two witnesses this afternoon from out of town who will have to leave. I know that you have a very heavy schedule and are tremendously busy. We would not want to impose upon you, but we probably will have to ask you to come back tomorrow morning.

Mr. GARDNER. All right.

At Mr. Wilson's request, I will be engaged tomorrow morning. Tomorrow afternoon will be fine.

Mr. RIEHLMAN. Just leave it as a temporary appointment. We will make our plans along that line. If something interrupts, we will let your office know.

We will now stand adjourned until 1:30 o'clock this afternoon.

(Mr. Trevor Gardner's testimony of June 11, 1954, follows:)

Mr. GARDNER. Your seventh question was:

Your reactions to the reported problems and issues set forth in the enclosures.

With your permission I will list each of the points in the two enclosures and then follow with a reaction to each of them as requested.

Enclosure 1 had as its first point: A. "Are there any characteristics inherent in a military organization which are incompatible with the administration of an effective program of scientific research and development?"

There are no characteristics inherent in military organization which are, in our opinion, incompatible with the administration of an effective program of scientific research and development. When the nature of the mission is taken into account, it will be found that military organization for research and development follows the same general pattern as modern industrial organization, taking full account of the sound-management principles of delegation of authority and careful assignment of responsibility. The military organization is, of course, less conducive to an optimum environment for basic scientific research than the organization of the university campus, but this is inevitable in view of the basic difference in missions between the two and the ever-present pressure of time in the military program. This fact is recognized and for this reason the scientific research in the Air Force program is in general conducted by contract with universities and similar institutions.

Mr. LIPSCOMB. Do you have any questions, Walter?

Mr. BALWAN. No; I have no questions on that. Do you have anything?

Mr. LIPSCOMB. No. We will go on to the next one.

Mr. GARDNER. B. "Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?"

The military organization of a research and development program does not of itself tend to create conditions which retard the work of

scientists or make it difficult to obtain and retain the services of highly qualified scientists and technical personnel. The major factor leading to the above problems is the inability of the Government to pay salaries competitive with industry or even universities. Our civil-service grade structure is not as flexible as the industry pay scale and thus on a short time basis we are not able to compete with industry. It is recognized and accepted that the military organization and structure cannot offer the basic scientist complete freedom in his activity. This does not present a major problem since the Air Force does not, in general, perform basic scientific research in-shop.

Mr. LIPSCOMB. Has there been any proposal to increase the pay of scientific technical personnel?

Mr. GARDNER. There have been a variety of proposals at one time or another. I have made a specific proposal in collaboration with Dr. Robey, chairman of the General Advisory Committee of the AEC, where I understand they are doing the same thing. That is, for our people to explore and attempt to develop something we might bring to the Congress which would provide us with an incentive that will be made available for outstanding achievements—a financial incentive similar to the British system, where, for example, they gave Frank Whipple 100,000 pounds and made him a knight for his outstanding work. We were thinking in terms of awards up to $25,000 as the kind of incentive thing that would really put strength into the Government laboratory.

Mr. LIPSCOMB. Has there been any survey made as to whether or not your wages or salaries are comparable with private industry?

Mr. GARDNER. Yes. There have been surveys in almost every area where we have a center. Personnel people in those areas have quite a mess of information on that.

Mr. LIPSCOMB. Is there a big discrepancy between the two?

Mr. GARDNER. I do not have the accurate figures. Do you have that?

General KELSEY. In general the experience we had in personnel administration at Wright Field is that the pay scales very from low ranks up to high ranks, so it is impossible to characterize these things exactly. In general, the very highly paid individual scientists we couldn't compensate in any way in comparison with industry. On the other hand, the lower grades, graduates from college just coming in, in general got better pay and better opportunities than they did on the outside. So you cannot categorize the whole thing.

Mr. LIPSCOMB. Perhaps it might be well if you do have any surveys to give them to the committee, so that we can kind of look at the comparison of industry as against the military or the Government service. I think it would be interesting to see.

Mr. BALWAN. Do I take it you say there are no problems you are aware of that create conditions which retard the work of scientists?

Mr. GARDNER. None that security and normal procedures you have to have in Government business do not impose.

Mr. BALWAN. Are there any problems which prevent the development of technical officers in the Air Force? I mean, that make it difficult for officers to look for a career in the Air Force?

Mr. GARDNER. Yes. I think there are problems and we have to recognize them, and I think we do. One of the problems is that in

the Air Force, as in the other services, a specialization of any kind, particularly a specialization in technical fields, usually makes it quite sure that one can never become Chief of Staff. Since the fundamental policy on which the officer corps works is that everyone should be able to look ahead to some day when he might be Chief of Staff, this is a definite negative.

So perhaps this takes some of the more aggressive, and some of the more brilliant people and causes them to want to stay in operations instead of specializing.

General Twining has been quite concerned about this. The kinds of people who have been assigned to run the Air Research and Development Command tends to refute this. General Partridge, who is now in the Far East, is one of our top operations officers, and he was commanding officer of the Air Research and Development Command.

General Power, was Deputy Commander of the Strategic Air Command and was relieved of that job to come in and take over. So while the problem is there the people at the top level tend to refute the situation and to encourage people that this is a good career. But I think the facts are quite simple that people prefer operations because it is better for their career.

Mr. BALWAN. Have you talked with Colonel Osgood from ARDC about his problems, or has he called them to your attention?

Mr. GARDNER. His predecessor, Colonel Hoysington, came in and spent considerable time with me about a year ago, and subsequently from time to time I have talked with him about the problems.

General McCormick, who was unable to be here this afternoon, has been one of the officers principally concerned with increasing the quality of the officer personnel in the ARDC, and getting both more officers and more technically educated officers. A little later on, in my summary, I have the number of technical officers we have.

Mr. BALWAN. Is this problem related at all to scientific personnel turnover, or is that mentioned later on?

Mr. GARDNER. The turnover figures are mentioned later on.

Mr. BALWAN. I have no other questions.

Mr. LIPSCOMB. Mr. McCormack.

Mr. MCCORMACK. No questions.

Mr. LIPSCOMB. You may proceed.

Mr. GARDNER. C. "Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?"

Professional officers must be in a position to determine what is technically required to fight an air war and further must retain the power of decision as to when a research and development project is ready for production and service use. Even in the area of fundamental scientific research, careful study has determined that integration into the overall military program is essential. In the final report of the Ad Hoc Committee on Basic Research of the Research and Development Board, dated June 3, 1953, the chairman, Mr. Warren Weaver, states emphatically that the important purposes of scientific research and development in the military program—

cannot be served as effectively unless the basic research activity is intimately immersed with the structure of each of the three services.

In this same report the committee recommended strongly against the concept of a single civilian organization to perform research and development for the military services.

I would like to add a comment or two. In the last few days I have been working with the British Minister of Supply and their Comptroller of Guided Weapons and Electronics. As you know, they have just this sort of system. I am also working with their chief scientist. They have much the same kinds of problems as we do, and they are not any more sure they are right than we are.

We talk rather frankly about the advantages of their system as opposed to ours. They state quite frankly in the field of guided missiles that we are way, way, way ahead of them.

It is not clear this is because we spend more money, or because we are organized to do the job differently. Frankly, we didn't arrive at that. It is a complicated business and I wanted to mention in passing that the British are just as confused as we are about it.

Mr. LIPSCOMB. Does this report refer to the top administration level, such as yourself, where we have the civilians against the military, or does it refer to the base level, such as Rome or Wright Field?

Mr. BALWAN. The Weaver report.

Mr. LIPSCOMB. The Weaver report.

Mr. GARDNER. It refers to the organization of the basic research activity to be accomplished by the various centers.

Mr. LIPSCOMB. And it specifically recommended that a civilian organization would not work out?

Mr. GARDNER. Right.

Mr. LIPSCOMB. At a level such as Rome or Cambridge?

Mr. GARDNER. That is right. It was talking about getting the total research and development job done.

I might add another comment. Recently we decided we wanted to strengthen our guided missile organization. My first inclination was to think along the lines of the Manhattan District type of organzation, where we pull it off to one side and set it off with a civilian show. I examined that quite closely and completely convinced myself and my boss in turn that such a thing would have an extremely difficult time working.

First of all, you would have the problem of setting it up, which takes a lot of time and effort. Secondly, it would be competing for facilities, with residual military organization; and, thirdly, it would always have, as we did in OSRD, the Office of Scientific Research and Development, during the war, a serious sales problem. This is one of the things that the British people have the same problem with. Their product is never just right for the military. They always find that the military want modifications that they had not thought of, and which would have been thought of or perhaps would not even exist if the military developed this themselves.

In the Office of Scientific Research and Development we unfortunately had the problem of taking a new rocket development, let us say, and literally selling it and convincing people that it was a useful thing. That problem does not exist in any size at all with the military civilian organization.

So it was for these reasons that we decided in the Air Force to strengthen our research and development on guided missiles by assign-

ing more general officers to it and by creating one higher job—an assistant chief of staff for guided missiles.

Mr. BALWAN. What considerations led you to set up Project Lincoln, which is operating through MIT?

Mr. GARDNER. I think the same thing that usually motivates the initiation of any large project, good laboratory people. To be specific, there was Dr. Hill, and Dr. Zacharias, Dr. Wiesner, Dr. Valley, and Dr. Hubbard, who represent a degree of competence not found anywhere else in the country in their particular field; and who have access to a lot of fine technical people. Furthermore, the leadership of Dr. Killian and his willingness to accept it was the reason why it was set up the way it is, and at MIT.

Mr. MCCORMACK. You say Dr. Killian wanted to continue it?

Mr. GARDNER. Dr. Killian realized that Project Lincoln was a very serious load for his institution to carry. It was only because of his complete concern for the status of continental defense and the need for technical improvements in air defense that he reluctantly agreed to take on the job. I think as a result of some of the difficulties that have occurred since he took it on, that he sometimes wishes he had not. They are doing a fine job for us, however.

Mr. MCCORMACK. The speech he made not long ago that I inserted in the Congressional Record was about his concern for universities and colleges maintaining their primary objectives. Did you read that speech?

Mr. GARDNER. I did not read it. I just heard about it.

Mr. MCCORMACK. He was confining himself, I suppose, to the experience at MIT, but I suppose he was concerned with MIT by reason of the workload being changed temporarily at least from an educational institution to a research institution.

Mr. GARDNER. He has fine men like——

Mr. MCCORMACK. I may be wrong, but I am just giving it to you from my understanding.

Mr. GARDNER. I think he needs to be concerned because the primary mission of a place like MIT or Caltech is to do the educating job and to do a research job, as close to fundamental research as they can stay. They want to do this, but they find their personnel—for example, Dr. Zacharias is doing some extremely important work in experimental physics—nuclear physics. He is only able to spend approximately one-third of his time on this. The other two-thirds he has to spend doing chores for the Air Force and working on Lincoln * * *.

Similarly, Dr. Wiesner has one class he teaches and he is only able to have four graduate students working for their doctorate under him. He should have about 10 graduate students and should be able to attend to his class that he teaches more than once a week, and that is about all he averages.

Mr. MCCORMACK. You said that the Lincoln project is a success?

Mr. GARDNER. I consider it so.

Mr. MCCORMACK. I have read something, and I do not profess to know much about it, because that has to be secret. The first time I met Dr. Bush was when we had to get $1,600 million or $1,800 million in 2 fiscal years without letting the Germans know we were appropriating what I later found out to be the Manhattan project.

I did not even know what it was. I knew there was something going on and Secretary Stimson was there, and General Marshall. We knew that it was a race for time between our country and Nazi Germany to perfect this bomb. That is what they told us. And whoever perfected it first—if the Germans did perfect it first they could defeat us overnight. Their chins were down on their chests and they said it might be $2 billion thrown down the sewer. But we went along with it.

I did not want to know too much about top secrets, because I get worried about them. What I do not know I cannot even unconsciously talk about. But I read somewhere that there was a recommendation or some of them thought it would cost about $20 billion for continental defense. Was there anything like that?

Mr. GARDNER. There have been various estimates, depending on what kind of a defensive system is needed. I have seen estimates ranging from $5 billion to the largest one, which was $50 billion, depending on how much defense they are attempting to buy and how you go about doing it.

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It is research and development to see that that expenditure is reasonably well spent on the right things.

Mr. MCCORMACK. I am not disputing that, but I just thought $10 billion altogether.

Mr. GARDNER. I say at least $10 billion.

Mr. MCCORMACK. I noticed Dr. Conant and Mr. Hill wrote an article in a national magazine last December which I also inserted in the Congressional Record, to the effect that the continental defense could be developed where the attack planes might be reduced to between 5 and 10 percent, with not too tremendous an expenditure of money. Did you see that article?

Mr. GARDNER. No; I did not.

Mr. MCCORMACK. A man like Dr. Conant's views are worthy of profound consideration, I think.

Mr. GARDNER. They are indeed.

Mr. MCCORMACK. Even in the military field.

Mr. GARDNER. Definitely.

Mr. MCCORMACK. As well as in the field of science. Do you know of Mr. Hill? A. J. Hill I think it is.

Mr. GARDNER. That is Dr. Hill, of MIT.

Mr. MCCORMACK. I think they wrote an article jointly. Both of them wrote about it.

Mr. GARDNER. He is director of Lincoln Laboratory.

Mr. MCCORMACK. What concerned me was I read some months ago where Secretary Wilson said that 75 percent of the attacking planes could get through to their target. I have read later where Mr. Flemming, who is head of the Civilian Defense, said that we had 15 minutes' notice. You saw that, didn't you?

I was somewhat surprised, but I cannot ignore a statement coming from that source, and from Secretary Wilson. His statement was made some months ago.

Then I read where Chairman Short said that from 60 to 75 percent of the attacking planes could get through to their target. Of course, that concerned me and I made several speeches on the floor of the House. No criticism; but I was very much concerned not only for a

powerful offense, but I am concerned with obtaining as powerful a defense as we can have to protect our cities and our people.

I read Dr. Hill's and Dr. Killian's article, which said that we could build an adequate defense without any $20 billion outlay. I know it said that. And where the attacking planes could be reduced to between 5 and 10 percent, in any event, a considerable reduction.

Of course, in my mind as a layman there comes then the further deduction that that might result in the saving of millions of Americans being killed and wounded in case of a sneak attack. Did you see those articles?

Mr. GARDNER. I did.

Mr. MCCORMACK. Those are some of the things that run through my mind. No criticism; but I am concerned with a strong defense. I am concerned with the strongest possible one in the light of the threat that confronts us. If we are going to err I would rather err on the side of strength rather than weakness.

In regard to our defenses, Mr. Secretary—without going into the defenses of our cities and their people—based upon your knowledge, what would be the percentage of attacking planes—because when a sneak attack comes it is going to come from the other side. I will not discuss whether we should engage in it or not, but democracies do not, so we are faced with what appears to be an indisputable fact. What would be your opinion as to the number of attacking planes in the light of our present defenses that might get through to their target?

Mr. GARDNER. It would depend on two things: (*a*) the amount of intelligence, that is real early warning—through intelligence. If we had a week's leave this percentage could be greatly increased. And (*b*) the nature of the attack—as to whether it was an extremely high attack and in tight formations, or individual planes, and the massiveness of it.

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Mr. MCCORMACK. This is in executive session and I think, Mr. Chairman, I might suggest that any things that take place here, particularly in the military field, we might look them over to see if there are any top secrets that they might want to edit in case this testimony is released later on. What do you think?

Mr. BALWAN. That has been our understanding and Mr. Riehlman approved the idea.

Mr. MCCORMACK. So that we would not be unintentionally and unconsciously the avenue of giving potential enemies some information.

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Mr. MCCORMACK. Even that point about the Soviets taking possession of the hydrogen bomb was something that Intelligence figured they would not have for as much as 3 years. They gave their best judgment, based on the information they had. However, they had it 3 years quicker than our Intelligence thought they would have it.

Then on the jet bomber my information is they figured they had it at least 2 years quicker than they thought they would, or at least 2 years. If we could rely on Intelligence—and I am not criticizing it because I am assuming they are doing the best they can—that would be one thing, but we had better have something more than that.

Mr. GARDNER. That is right.

Mr. McCormack. We had better have radar and interceptors. The way I look at it, the best possible system is none too good.

Mr. Gardner. There are a number of things that can be done. There is a program of things to do that is laid out by the NSC and by the JCS, directed by Mr. Wilson. This program of things to do should improve our ability to knock down the enemy planes.

I am personally not satisfied that we are displaying enough of what you might describe as a sense of urgency in implementing that program. In order to explain that remark, if I may, Mr. Chairman, I would like to say something here.

Mr. Lipscomb. Certainly.

Mr. Gardner. This is a digression, but perhaps an important one. The business of what you should do, and at what rate, and who should do it, in implementing a continental defense plan, is an extremely complicated mixture of technical opinion, political opinion of intercountry political problems, and in-service problems. We do not have——

Mr. McCormack. You were using the word "political" in its broadest sense.

Mr. Gardner. In its broadest sense.

Mr. McCormack. As applying to government.

Mr. Gardner. That is correct.

I might just address myself to the technical component of this complexity. There is in science and technology, as you know, a spectrum of opinion about how to go about getting a technical job done. For example, you will always have an extreme optimist perhaps on the verge of being a genius, who as soon as the idea appears on the horizon, assumes that the problem is solved.

Then you have the extreme conservatist on the other hand who says, "That is a great idea. Let us build the hardware and test one of them. If 1 works we will build 10 and then we will get some field experience and if the 10 work we will know what to do to modify it, and then we can build the 500 that we need."

This spectrum of technical opinion is present everywere, but in continental defense it is causing us an awful lot of trouble. With the proper sense of urgency on the part of the people engaged in making these decisions—there is an urgency and I am not sure that we can get to them too easily—but with the proper sense of urgency the spectrum of technical opinion narrows down because the conservatists are willing to take more of a technical chance, and the extremist is already about as extreme as he can get anyhow, so he just does not get more extreme, so the decisions would come faster.

I have looked at this extremely closely and I have tried to evaluate whether we were doing enough research and development on continental defense. In order to evaluate that you have to say what you want in the way of continental defense and look at the whole problem.

I think there are a number of things we can do, and steps are being taken, I believe, to see that these things are done to improve this. There is one specific thing that I feel very strongly on, and Drs. Killian and Hill do also. We are doing our best to convince other people within the spectrum of technical and political opinion.

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Mr. McCormack. That is a long ways off; isn't it?

Mr. Gardner. It is too far off. It is not necessary to have all of our ground environment equipment working 100 percent in order to

use that line. That line is related to the Strategic Air Command's ability to survive and get off the ground. It is one of the most urgent things, and a sense of urgency I believe is beginning to be developed about this particular part of the expenditure. This is the kind of thing Dr. Hill had in mind when he said for $50 million we can get the far north line. We still have a number of technical people who say, "Let us go slowly." We still have a few testing stations working and there are lots of problems; let's not leap into it madly; let's go one step down. That is the problem.

Mr. McCORMACK. When you are faced with an emergency, sometimes you had better have quick action. Let us take the Manhattan project, as an example. That was a gamble; was it not?

Mr. GARDNER. That is right.

Mr. McCORMACK. As I understand it, the real secret was not what was in the bomb, but how to make it.

Mr. GARDNER. That is right.

Mr. McCORMACK. That is what Dr. Bush told us at the time. In other words, assuming at the time we had the conference—and Speaker Martin was there as the minority leader at the time, and Speaker Rayburn, because we were in control and this was a meeting of Americans with nothing political transcending that—I remember at the time Dr. Bush said they had perfected it to about 10,000 tons of TNT destructiveness, and they assumed if they got it that far, all you had to do was to make your processes of perfecting it 5 times stronger. But I believe that is not the secret. It was after the British had pulled off a commando raid, as you gentlemen know, in Norway. I remember reading a little squib about it in the paper. It was one of the most heroic stunts pulled in World War II. It was a raid on a plant that the Germans had in Norway. It was around that time.

We now know that they thought the potential destructiveness was 100,000 tons, and now we have an idea of what some of them are.

All I know is, there is action, and I will support that action even to the extent of more taxes. I will support it if it is coupled up with expenditures for defense.

Mr. GARDNER. My responsibility in this business is the research and development, and to attempt to force the decision to produce on things that are important to national defense. You do not go very far along that line before you find yourself away out of the research and development field and over in the business of how to fight and win wars, and strategy, and so on.

Mr. McCORMACK. For example—and I wish you would edit any questions I ask along the line that should not be in here. When you come to them, strike them out. I understand the hydrogen bomb, which is far more destructive than they thought—I understand that what happened to the Japanese fishermen might have been a godsend to us because it gave us some ideas and thoughts as to what might flow from it. If a bomb was landed in Washington and the wind was blowing toward New York they might have to evacuate every city in between. Whatever is contained in the cloud and is coming down might have an effect on the human beings. There are an awful lot of other questions besides just tossing a bomb and killing a lot of people. There are a lot of other things to consider that flow from it. In other words, the bomb itself is not the only ultimate damage. I realize these are all serious questions.

Now, coming back to your statement, you said:

> Professional officers must be in a position to determine what is technically required to fight an air war and further must retain the power of decision as to when a research and development project is ready for production and service use.

That production and service use is after the basic scientist has operated.

Mr. GARDNER. Right.

Mr. MCCORMACK. And after the applied field has gone through. That is getting into where it is probably determined to be workable and they take over as practical men and make it workable and deliverable. In a broad way that would cover that; would it not?

Mr. GARDNER. Right.

Mr. MCCORMACK. What about the professional officers being in a position to determine what is technically required from the angle of basic research?

Mr. GARDNER. Actually they do not do that. Usually the scientists themselves and the committees, such as Weaver's committee of the SAD, will assist in the development of a basic research program.

Mr. BALWAN. Does the Rand Corp. do some of that?

Mr. GARDNER. No.

Mr. MCCORMACK. You say the Weaver committee said it "cannot be served as effectively." I had better read it all. You say:

> Mr. Warren Weaver states emphatically that the important purposes of scientific research and development in the military program "cannot be served as effectively unless the basic research activity is intimately immersed with the structure of each of the three services."

I can understand that. But take the professional officer. This is no criticism, and I do not want it to be construed as one. But a professional officer in the field of basic research I can understand being intimately immersed in all of the spheres of that activity within the scientific field because they are intimately immersed with one another. But what about responsibility in control? That is important, it seems to me.

Mr. GARDNER. Yes. We outlined the organization we have for the control.

Mr. MCCORMACK. I am not talking now about a single civilian organization.

Mr. GARDNER. Yes.

Mr. MCCORMACK. I am not talking about that now.

General KELSEY. Mr. Secretary, the subject of high energy fuel perhaps illustrates this. The military requirement for increased range might assume a very high priority, and the limiting factor might be fuel capacity. This then would be a dictation of priority by military act, dictating the actual development of the high energy fuel, which is a basic research problem over which no one in the military requirements area at least is going to direct specific action. Nevertheless the very decision at the beginning of this would be based on the military priority, which understands there is a capability in this area which perhaps would pay off.

Mr. GARDNER. Yes. Another example, if we can do it by way of example, is the military requirement to have a fighting machine that that will fly at mach 2. This immediately means you must have powerplants that are reasonably small, but extremely powerful, because you don't want to drag a big thing through the air.

This further suggests that the only way to get it is with high temperatures. You immediately find that the oil in such high temperature engines will break down, so you have to go after a basic research program to find out and understand what happens to oils, and examine various kinds of oils, and even perhaps synthetic oils that will withstand the 800 or 1,000 degrees temperature it will encounter. This is the kind of thing we are talking about where the military need, determined by professional military people, dictates some of the basic research program.

Mr. McCormack. Of course, a scientist is a scientist, whether he wears a uniform or is a civilian.

Mr. Gardner. Yes.

Mr. McCormack. They have the mind of a scientist. But take an officer who is not a scientist and who is in command. Then a technical question comes up. You can see where there would be an honest conflict there that would result harmfully.

Mr. Gardner. I do, and it happens every day.

Mr. McCormack. You say it happens every day. How does that happen every day, and why should it?

Mr. Gardner. It happens every day in civilian organizations where a reasonably uninformed person in a position of command cannot accept or understand what is brought up to him. This is just because no organization is perfect. You do not always have the right man in the right job. That is what I was trying to say.

Mr. McCormack. We have evidence in connection with Cambridge where there was a technical deputy and he coordinated three bureaus. He was on the staff level and the highest civilian. He was an electronic specialist. There is no question about it and the testimony clearly shows that as to his qualifications in electronics, which of course was knowledge gained from years of experience and study which he had in geophysics and the atomic arms—well, the position was abolished. That was the highest civilian position there and it was on the command level. Later he was in the position of Technical Director, which was temporarily established, and abolished. That was an expedient for temporary purposes, I assume.

Now there are three Directors—the Acting Director of Electronics—there is no doubt about it—is a research psychologist; an able fellow. But your line of command now is down on the bureau level. The civilian who was up in the command level coordinated three bureaus, and the activities made decisions of a technical nature. Of course, he had no trouble with the other general, but this new general comes in and the position is abolished.

There is an illustration of evidence that might show a conflict going back to the military being in command and doing something that was probably unwise. I do not know. I have not reached a conclusion yet. I am just weighing the evidence on that. I would not reach a conclusion on that because it is only an isolated part anyway.

An honorable man in the military service, but the man who preceded him was respected by the scientists because they considered him one of them. He was a man with that background and experience, and he was in the scientific field.

Now, take that case there. Do you not think it is advisable to have a civilian representative qualified in a place close to the com-

manding officer so that he could not only advise him, but the technical staff feels they have somebody in a command position.

Mr. GARDNER. This is a difficult question because it is really not an organizational question, but a personality question.

Mr. MCCORMACK. No. The general said he wiped out the position and would not restore it, in his opinion.

Mr. BALWAN. He could have just fired Marchetti, and left the position of Technical Director or Deputy Director, but he did more than that. He abolished the position.

Mr. GARDNER. Without commenting on the problem, both Marchetti and Foley should have been fired a year earlier, in my opinion.

Mr. LIPSCOMB. What was the other name?

Mr. GARDNER. Foley. He is still there. It is part of the personality conflict that goes on.

Mr. MCCORMACK. I would not mention that because you might get into something where you might open up the question further than you expect to. I was asking you——

Mr. GARDNER. But there is no way to answer your question on purely organizational lines because it is a personality situation.

Mr. MCCORMACK. But if General Maude says it was not; he said he did not think—he answered the question that he would not recreate the position. He was more basic than that.

Colonel WATSON. General Maud stated to me that he would not recreate the position as long as the steering committee, which is now operating there, performs the job as well as it is presently doing. He feels the present organization is doing a better job than has been possible in the past, and even if he had enough money to hire a man who possessed qualifications that a man in that position should possess, including geophysicist, atomic warfare, and electronics experience, he still believes he would like to have it as it is now and let the steering committee run it.

Mr. GARDNER. Perhaps I could give you this information. I was concerned enough about it to go up to Cambridge and spend some time talking to people. I talked to Dr. Lansburgh, who was then heading the geophysics laboratory, and 1 of the 3 people you mentioned. I talked to Dr. O'Day, who was a researcher in one of the laboratories and a very fine man, whom I respect.

I talked to Dr. Killian, Dr. Hill, Dr. Zacharias, and Dr. Wiesner and found they felt that the change that had been made was an improvement in the laboratory.

With the other duties I had I was not able to dig down in and talk to more people than that, but I respected all of those people's judgment. I talked to General Maud about it, and the reason for talking to these other people was to get an independent check on his opinion.

I understand you people have talked to some of these same scientists.

Mr. LIPSCOMB. May I interrupt?

Mr. GARDNER. Yes.

Mr. LIPSCOMB. Was the improvement because of the discharge of certain personalities, or was the improvement in regard to organizational structure at Cambridge?

Mr. GARDNER. I do not think you can answer that on an either-or basis. I think the improvement was the removal of a disturbing

influence which might have been because of the organizational structure.

Mr. LIPSCOMB. When a commanding officer makes a change in the organization of a large laboratory like that, is that a matter of his own judgment, or does he have to consult for instance with your office?

Mr. GARDNER. In this case the change was not discussed at a level higher than ARDC. It was also then discussed with the Chief of Development, General Craige. It was not discussed with me, and would not normally be discussed with me.

Later, when it appeared that there would be some difficulty about this, it was when I got into it and reexamined the thing and concluded they had made the right move.

Mr. LIPSCOMB. Is the organization at Cambridge the same as at other laboratories in the research and development?

Mr. GARDNER. No. As a matter of fact we do not have identical organizations at all of the laboratories.

Mr. LIPSCOMB. Do you have technical deputies or technical directors in the other laboratories.

Mr. GARDNER. Would you be able to say, General?

General KELSEY. Not as such. Not on a uniform basis. No. There are laboratories in which there are people who act in that capacity; there are others in which the compartmentation of functions within the laboratories in effect giving a staff which meets and provides the same function on a staff basis.

Mr. LIPSCOMB. Do you have any laboratories that have a senior civilian in them?

General KELSEY. The one I think of offhand is at Muroc at Edwards Air Force base. There is a chap who was in the flight test at Wright Field for a number of years and got out of the service, and as a civilian was No. 1 assistant to the commander out there.

Mr. LIPSCOMB. Is he in charge of a civilian staff?

General KELSEY. No, sir. None of this is, as the Secretary said, an either-or proposition. It is a proposition of integration there and not segregation. It makes little difference how you organize the figures to bring about the various integrations to the capacities. There are too many hands on the ball, and it must be held by people who are mighty skilled. It depends on the type of activity. If you have a series of finite functions then you can work in a staff basis. If the end product is more nearly specialized it frequently pays to have an individual. But that individual as such does not have experienced individuals under him; nor does the military commander have a string of military under him.

The ideal setup is the continuity provided by the permanent employee who is technically qualified; the ability to meet the mobile operational requirement on the part of the chap in uniform who is thinking in terms of using the end product in actual warfare; and a permanent secretarial staff who takes some of the administrative load off the other two.

Ideally in the past we found in our various offices at Wright Field over a long evolutionary period that the ideal setup was 3 desks together with 3 functions: The civilian engineer, a qualified military officer, and an administrative person. Sometimes within the organization these represent offices, and sometimes you can condense them,

down to individuals. But the functions are three legs on the stool and they are not independent in any sense of the word.

Mr. BALWAN. Mr. McCormack, since Mr. Gardner has an appointment with Secretary Wilson at 4 o'clock and he has consented to come here from 2:30 to 3:30, I wonder if I might suggest to the chairman, if we would like to have Mr. Gardner here again we might continue the week after next. As I understand it, he is on a very important survey next week.

Mr. MCCORMACK. Might I ask him 1 or 2 more questions? Do you know General Phillips?

Mr. GARDNER. No; I don't.

Mr. MCCORMACK. Do you gentlemen know General Phillips?

General KELSEY. Yes, sir.

Mr. MCCORMACK. He retired not so long ago as a major general.

General KELSEY. Yes, sir.

Mr. MCCORMACK. A good man?

General KELSEY. Excellent.

Mr. MCCORMACK. Excellent. Did you ask General Phillips about Marchetti?

Mr. GARDNER. No, I did not.

Mr. MCCORMACK: Did you make any inquiries about Dr. Schneider?

Mr. GARDNER. No. I just asked about Marchetti.

Mr. MCCORMACK. But you did not ask about Dr. Schneider. He resigned you know because he was being bypassed. They were going down to those under him and getting opinions without consulting him, and giving orders to him. That is not right, is it, if it is a fact?

Mr. GARDNER. I did not ask any specific questions about Schneider. His name came up during the course of the conversation.

Mr. MCCORMACK. He was Director of Electronics and he found many men under him being consulted by the general, and he was issued orders without being consulted or having any knowledge about it. On one occasion there was a meeting in one of their homes that the general had with some of those stationed there, without the Director being present or having any knowledge about it.

Now in regard to a steering committee, we all have experience with such, those of us who have legislative experience, but we are all on a basis of equality and in a position where a majority vote pretty well determines the situation. But we had evidence this morning—while it has never happened as I remember it, or it might happen very rarely, but it could in an important case—of a steering committee consisting of a commanding officer and a deputy and the heads of the electronics, geophysics, and atomic weapons divisions on a committee where the 3 civilians might disagree among themselves, with one feeling that money should be allocated to his division for a project on some particular matter, and they could not agree.

So, the witness was asked what would happen, and he said the commanding officer would have to make a decision. The committee under those circumstances is not really what you would call a steering committee in the true sense of a steering committee I would say.

Mr. GARDNER. I think it would be false——

Mr. MCCORMACK. I can understand that the commander is a man of responsibility. I am not disputing that.

Mr. GARDNER. I think it would be false for me to sit before the committee and represent we are complacently happy about our problems at Cambridge. We have a laboratory there that represents the fields such as geophysics on the highest plane with the—some of the highest people in the country. It is a fine laboratory. The electronics laboratory has been disturbed and upset. Our problem is to cause a series of management decisions to be made which will tend to calm the trouble so that the laboratory does not come completely unglued.

Mr. MCCORMACK. Apparently instead of calming it it is disturbed, because under General Phillips you had no trouble according to the evidence.

Mr. GARDNER. As recently as last Tuesday I had a meeting with Dr. Zacharias and Dr. Hill and Dr. Wiesner and I asked their opinion of whether or not the inside workings of the Cambridge laboratory—as to whether there was a lot of upset feelings.

Without naming the people they said they thought the confusion and disturbance was related to just one or two, or possible three malcontents.

Mr. MCCORMACK. What relationship does Cambridge have to the Lincoln project?

Mr. GARDNER. Cambridge—one of its jobs is to service the Lincoln laboratory. They are physically adjacent. There is a great deal of interchange of information and talk back and forth. I did not go up for the specific purpose of asking their opinion, but casually asked it.

Mr. MCCORMACK. The top technical deputy, or director at Cambridge would have to make some decisions in relation to some of the activities of Lincoln, would he not?

Mr. GARDNER. That is correct.

Mr. MCCORMACK. Did you look in to find out whether there was any feeling against him because of some of the decisions he might make that he thought were in the Government's interest?

Mr. GARDNER. Against——

Mr. MCCORMACK. Lincoln.

Mr. GARDNER. I just respect the opinion of these three men I mentioned, particularly Dr. Zacharias, one of the outstanding physicists in the country.

Mr. MCCORMACK. But a human being.

Mr. GARDNER. All three of them.

Mr. MCCORMACK. Yes; but they are all human beings like we are, with emotions of human beings.

Mr. GARDNER. I frankly did not want to go into the laboratory personally, and just felt that would make more problems.

Mr. MCCORMACK. We have not gone into it at all. You brought it in. My question was not directed to that. Not that I am criticizing you, because we do not want to get into personalities. We would rather keep away from it.

Mr. GARDNER. We have a very delicate instrument in the laboratory, and our job is somehow to cause the place to again have—to quiet this general disturbance down so that we can get good people attracted there. That is our job. We may not be going about it in the right way, but I think we understand what our job is.

Mr. MCCORMACK. I am not criticizing you. It is your job, but I know under General Phillips there was no disturbance. I suppose

there were human irritations, but there was no disturbance. It all came afterward.

Mr. GARDNER. I was not there at that time. So that is why I say he could not be more fully informed than you have been because you talked to them directly.

Mr. LIPSCOMB. Mr. Secretary, we have evidently some testimony you are not aware of. Would you like to see that testimony and evaluate it, and perhaps you will see some of the conditions we found up there that you do not know about at the present time.

Mr. GARDNER. I would be glad to.

Mr. LIPSCOMB. I know you must go but you mentioned that the Lincoln project and Cambridge were physically next to each other.

Mr. GARDNER. Yes.

Mr. LIPSCOMB. Why is it that a project such as the one at Lincoln was given to a private or separate institution instead of being done right at Cambridge?

Mr. GARDNER. Cambridge did not have the technical competence to do it. It is a 1,500-man effort, $20 million a year; and the Cambridge management structure at that time just could not possibly have handled it. Nor could it have attracted in the time necessary, the kind of competence we were able to get by going to a contract with Lincoln.

Mr. LIPSCOMB. You are just going to be able to make your appointment. Would you be willing to come back the week after next?

Mr. GARDNER. I would be very happy to.

Mr. MCCORMACK. I think we ought to make it at the convenience of Mr. Gardner because he has been very cooperative.

Mr. GARDNER. I would very much appreciate seeing this record because it might be helpful to us in a solution of our problem.

Mr. LIPSCOMB. We will bring that up for the subcommittee to consider, and let you know on that. We will continue the presentation of your testimony here then at your convenience, and possibly if we can arrange it for the week after next that would be best.

Mr. GARDNER. All right.

Mr. BALWAN. May I suggest, Mr. Chairman, in the event we do not get Mr. Gardner here again, that we consider at this point introducing the comments that he has written up in his statement, and then his subsequent appearance before the committee may be merely an elaboration on these questions and answers, and on any further questions than those commented on here.

Mr. GARDNER. I will be back from this survey on Thursday, and then I have to go to Quantico with Secretary Wilson, but I will be in town next Thursday.

Mr. LIPSCOMB. Mr. Balwan, you mean, in case he does not come back?

Mr. BALWAN. Yes. If we would introduce this in the record at this point as being his comments on the particular questions we have, then when we get him back, we can have further questions and further discussion on these questions or on any other questions we may have. In that case at least we would assure ourselves that we have a comment on this.

Mr. LIPSCOMB. All right. Then without objection we will enter these into the record at the present time, and when you return we will expand on them at that time. We know you have to go away and we

appreciate your coming up today and giving us your valuable time.

(The document referred to is as follows:)

D. Would it be feasible to organize military research and development program in such a way that the technical activities capable of being performed by a civilian organization could be separated from those which are purely military, such as support functions? Where military support activities are necessary in connection with a research and development project, and such activities must be under a military commander, does it necessarily follow that the technical research and development functions must also be under direct military supervision?

In certain instances it has been found feasible and practical to organize Air Force research and development in such a manner that these technical activities which can better be performed by civilian agencies are separated from those which are purely military. For instance, such projects as Lincoln have been assigned as primary technical responsibilities to specific scientific groups and have been provided with military support where needed and where it has proven most economical to do so. In these instances the technical supervision of the project itself is under a civilian scientist. However, in such cases it must be recognized and accepted that control by the Air Force of these technical programs is absolutely mandatory if the work so produced is to satisfy a military need at the required time. Again it must be upon the basis of a military requirement that all parts of these programs fit together to produce an operationally efficient combat system. With respect to the second question the answer is "Yes," in our opinion the technical research and development functions must also be under direct military supervision. This does not in any sense, however, imply that the technical research and development functions under direct military supervision at the top automatically dictates immediate and direct military supervision at all subordinate levels within any given research and development organizational structure. Those positions which require an input of actual, rather than purely theoretical, operational experience and know-how must have appropriately qualified military incumbents; all other positions should be filled when they become vacant with the best qualified person available or obtainable, be he military or civilian.

E. To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs? To what extent should private, nonprofit institutions participate? To what extent should private industry participate? How much "in house" research is required for the military services to be capable of exercising qualitative control over research and development conducted by outside laboratories?

My reaction to these questions is that I do not know the exact extent to which the Department of Defense should do any of the things to which the questions relate. We have recently reviewed the extent and scope of our program of contracting with nonprofit institutions with the result that we concluded that we were not placing an inordinately large amount of work with such institutions. I think we can best answer this question by simply stating the extent to which we are presently engaged in doing the various things which are questioned. These figures are being supplied in a separate document.

SECTION II. REACTIONS TO REPORTED PROBLEMS IN MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

I will now address myself to enclosure 2 of your letter, which was entitled "Reported Problems in Military Research and Development Programs."

With your permission, I will first read the problem and then give you my reaction, as requested.

I. "Civilian scientists in military research and development centers are reported to be generally dissatisfied with military domination and administration."

As I pointed out before, Mr. Chairman, we in the Air Force employ few people who could be categorized as scientists. Amongst these people who are the engineers or technicians, I know of no general dissatisfaction due to operating in a military atmosphere. I have avoided the use of the word "domination" since I know of no instance where domination could accurately describe the relationships of civilians and military at any echelon of our research and development organization.

II. "Civilian scientists are leaving military research and development centers in a general exodus."

The best available figures do not support the contention that large numbers of technical and scientific employees are leaving the Air Force because of dissatis-

faction with working conditions and military-civilian relationships. Actually, the rate of loss of scientific and technical personnel in ARDC, 15.7 per 100 employees annually, is roughly the same as that in private industry, nonprofit research organizations and NACA, and has decreased in the last year. Attachment I indicates the specific figures in this regard.

When it is considered that private industry consistently pays better salaries, and manpower and budget fluctuations cause Government employment to be somewhat unstable, it is surprising that turnover among scientific and technical personnel is as low as it is. It should also be pointed out that a study conducted recently by BLS (Bureau of Labor Statistics) revealed that, contrary to general opinion, technical and scientific personnel are an exceptionally mobile group, shifting readily from one type of employer to another and to different parts of the country.

In spite of the favorable comparison in loss rates indicated above, the reasons as to why our scientists leave is still of major concern. A study was made at Wright Air Development Center, which has approximately half of this type of personnel in ARDC. A tabulation of the results is indicated in attachment 2. The study covers a period from November 1, 1952, through October 31, 1953. It will be noted that only 5.3 percent gave dissatisfaction with working conditions as their reasons for leaving. Although military domination and supervision may have been a factor in some of the 12.3-percent cases where no reason was given, it should be noted that in no case was this reported as a specific reason.

III. "When a military organization is imposed on a research and development program there is a tendency for the military to extend its control over technical decisions and operations in the research laboratories."

In our experience the imposition of a military orgarization on research and development programs does not result in an expansion of military control over technical decision and operations in the research laboratories. Military commanders and responsible military personnel in managerial positions have a very considerable duty and moral responsibility to direct and manage a program in the most efficient and economical manner in exactly the same way as the manager or operating vice president of a company. Good management procedures in industry and in the Air Force are not incompatible with sound technical decisions and operations in a research laboratory, yet the owner of the company or the responsible military officer must see to it that the stockholders or taxpayers are getting the maximum possible efficiency from the people in the working groups.

IV. "Military research and development officers are not scientists who command respect of the civilian scientists."

There is an ever-growing percentage of officers in the Air Force research and development program who are well qualified as scientists and do command the respect of civilian scientists. For example, as of July 31, 1953, out of a total of 2,354 officers assigned to technical positions in the Air Research and Development Command, 163 had Ph. D.'s and 607 had masters degrees in a scientific or engineering field. Most of the remainder had at least a bachelor's degree in one of these fields. The engineering and scientific training program of the USAF Institute of Technology provides an important resource in supplementing these talents. In the current fiscal year 500 officers are undergoing advanced training in formal full time courses in engineering and science. On an average, between 85 and 95 percent of the technical graduates of the Institute of Technology are assigned to the Air Research and Development Command upon graduation. In addition to this, the Air Research and Development Command also conducts a very extensive formalized postgraduate study program at each of its research and development centers. The opportunities provided by this program are equally available to officers and civilians alike.

V. "The policy of rotating assignments for military officers militates against the retention of officers who in some cases have the training, talents, and disposition to guide scientific research centers."

Military history has shown that the value of an officer is lost if he is left too long in one specific assignment. Air Force research and development officers are not, however, rotated for the sake of rotation alone. In no instance is such an officer upon rotation knowingly placed in a position of less responsibility than the position formerly held. Barring unforeseen emergency requirements for skills in shortage categories research and development officers may now expect to remain in place for at least 3 years and in many instances for 4 or more years. It must be appreciated that assignments of officers are sometimes changed without change in duty station. This, of course, is no different than internal changes in the assignments of civilian technical personnel. It is the belief of the Air Research and

Development Command that present policies of the Air Force regarding the rotation of research and development officers is entirely realistic and in keeping with the mission requirements of the research and development program. It is because all research and development officers are eventually rotated to other assignments that ARDC places so much reliance upon the continuity represented by the key civilian scientists and engineers.

VI. "Research centers often are organized and administered as military organizations with the attendant restrictive forms, procedures, regulations, and military discipline which do not provide the optimum climate for research work by civilian scientists."

When the vital urgency of the military research and development mission is considered—the absolute necessity of remaining technically superior to the enemy at all times—it is clear that an optimum climate for research work by civilian scientists cannot be the only consideration. Certain disciplines are essential to insure that development schedules are met and that research remains in areas of direct relevance to the problems at hand. The investment of public funds in the production of weapons following the completion of research and development represents such a large part of the national economy that certain checks and balances which may be regarded as restrictive are absolutely essential for the protection of the public interest. Some or all of these factors may occasionally lead to the frustration of an individual scientist, but this, it is feared, is inevitable under any system of management sensitive to its responsibilities to the public.

VII. "The lack of either a definite or consistent policy for organizing and administering research and development centers leaves each center at the mercy of each change in commanding officer and this creates an instability with no assurance that even the well run research and development center will not become, with a change of officers, an unbearable situation."

It must be accepted that attendant to the change of an administrator in any organization, government or private, there follows in some degree a change in management philosophy and practice. In the cases of the ARDC centers, the mission of each is so well defined and the technical programs so carefully and constantly reviewed that there is little likelihood that a change in command will lead to deterioration of the program. One of the reasons for the establishment of Headquarters ARDC was to define the policies and organization for the administration of each research and development center. It is likewise the responsibility of Headquarters ARDC to assure that each center commander effectively discharges his mission to the utmost extent with the funds, personnel, and facility resources at his disposal. In the past the Air Research and Development Command has not refrained from removing military commanders who have shown incapacity to properly administer and organize. Should an occasion arise in the future where a center commander should be removed for inefficiency, such action will be promptly taken.

VIII. "Several outstanding civilian scientists who have been associated with military research and development programs are reported to be in favor of changes in the governmental organization and administration of these programs."

I am sure, Mr. Chairman, that a large number of persons who have been associated with military research and development programs from time to time have been in favor of changes in the governmental organization and administration of these programs. I believe that the transitory nature of their association, together with their specific application to some particular facet of the program, has caused them to fail to appreciate the fact that our management procedures have been ones of continual change, we hope, for the better. Likewise, it has been my observation that some of these recommended organizations have been self-serving in nature with the obvious objective of the recommended being placed in a position of considerable power and self-aggrandizement.

IX. "This funding of research and development is confused when handled with military budgets. Direct research and development costs are justified to and appropriated by the Congress as such. However, this does not give a true picture of the actual total cost of military research and development programs inasmuch as there are substantial indirect costs arising from military support functions in the form of pay for uniformed officers, provision of capital facilities, and certain maintenance and operation expenditures. In this connection, it is reported that it is often felt necessary to build up a research and development center with such support functions in order to make it 'respectable' in terms of size and complexity as a command for a colonel or general. This, in turn, sets off a vicious cycle in that the existence, of military support elements becomes a further excuse for military domination, more officers, regulations, etc."

As I previously stated, some of the costing aspects of our research and development program are extremely difficult to break out. I believe our cost summary for the fiscal years you requested is as accurate a picture as can be obtained at this moment. I believe, however, that much of the confusion created results from a failure to appreciate the involved nature of our efforts. We have constantly striven in the Air Force to provide costing procedures in a management structure so that we can identify the true cost of all of our operations. I am sure that the time here will not permit a complete rundown of the management procedures established by the Air Force to serve this function.

With respect to the second portion of this statement, I cannot conceive of any case within the Air Force research and development structure where such a practice could have been conducted. This is a frequent allegation which emanates from subordinates not only in military organizations but civilian as well whenever any new center is created for reasons best known to top management.

(The testimony of Mr. Trevor Gardner on June 23, 1954, follows:)

Mr. RIEHLMAN. Mr. Gardner, we hope that we can conclude our questioning you at an early hour this morning and get the additional information that the committee had requested and also to answer any questions that might have been left unanswered at the previous meeting.

Mr. Secretary, we are delighted to have you here again this morning and we will immediately hear whatever remarks you have to make at this time, and it is my understanding that you have prepared some answers for questions that were propounded to you at a previous hearing.

Mr. GARDNER. Mr. Chairman, I have not prepared any additional answers except the ones that were submitted here this morning and and it is not clear to me whether you wish me to go forward and read my testimony or insert it in the record.

Mr. BALWAN. We already had done that. I think the idea was to finish reading it and have some possible questions on that.

Mr. RIEHLMAN. I think it would be well to recognize that the Secretary has presented to us the answers to special questions that he was not able to answer at the previous hearing. Those will be checked over and whatever portions necessary made a part of the record. I think it is too voluminous to put it all in.

Then, in respect to the questions, as long as the answers have been submitted for the record, unless there are definite questions from the members of the committee, I wonder if we want to consume all the time to read all the questions or have the Secretary read them.

How do you feel about it, Mr. Lipscomb?

Mr. LIPSCOMB. I was trying to refresh my memory as to how we stopped this at the last meeting. I believe the Secretary was reading his answers at that time.

Mr. GARDNER. Yes, I had gotten down to item D. It is my recollection that you suggested waiving reading the balance of them and inserting them in the record.

Mr. LIPSCOMB. Yes, and then you were to come back and answer questions that might be asked.

Mr. GARDNER. Yes.

Mr. RIEHLMAN. I am awfully sorry that I had to be away that afternoon so I am not in a position to recall.

Mr. LIPSCOMB. Mr. McCormack was conducting most of the questioning at that point and he was the one who would like to have questioned the Secretary further.

Mr. RIEHLMAN. In view of that, I am just wondering if we might not go into executive session for about 10 minutes. We are in executive session but I mean entirely off the record with the reporter out of the room to interrogate the Secretary on another matter which we will make no record of and then if Mr. McCormack arrives, we will permit him to ask any questions that he has not had an opportunity to ask. If not, we will scan through them and if you have any questions or I or the staff director, we will proceed to ask them. If not, we will just excuse the Secretary and permit him to come back.

(Discussion off the record.)

Mr. RIEHLMAN. Back on the record.

For the information of Mr. Lantaff and Mr. McCormack, we had received some answers from the Secretary which we had propounded to him before and we will use whatever portion we will need for the record.

We had inserted in the record the questions we had sent to him. The Secretary is now willing to answer any questions the members wanted to ask him because apparently I think Mr. McCormack and Mr. Lipscomb are the last two members who were available on the committee to interrogate the Secretary and there were some questions in their minds at that time that they apparently wanted to discuss again with the Secretary.

I would like to pick up again at that point if it is possible.

Do you recall, Mr. McCormack, what line of questioning you had?

Mr. MCCORMACK. Yes, I think your statement is correct but I think possibly we have had some evidence in the meanwhile from other sources that have sort of clarified it in my mind.

To me, without committing myself—and I never like to close my mind until I hear all the evidence—but it seems to me that a very important thing is the matter of organization and development of the finest human organization possible to bring about the desired results between these two unusually divergent groups.

Mr. RIEHLMAN. I think that to some degree was covered off the record here with the Secretary when he was discussing this other matter that we wanted his information on. I think he did get into that field to quite a degree in this respect, that he had been confronted with this problem and was endeavoring as best he knew how to correct that problem.

I am sure he will be delighted to answer any of the other questions that the committee has to correct that situation and bring about better understanding and working conditions in that important field.

Do you have any questions, Mr. Lantaff?

Mr. LANTAFF. This is probably a bit outside of the scope of this particular testimony that has been taken this morning, but I am just wondering, Mr. Gardner, if you had occasion to look into the operation of the naval laboratory here in Silver Spring at White Oak, Md.

Mr. GARDNER. I have not. The only Navy laboratory I am intimately associated with is the Naval Ordnance Test Station at Inyokern, Calif.

Mr. LANTAFF. I have asked the staff to get this standard operating procedure that was issued out there by Admiral Schoeffel, and I realize that personalities were involved to a great degree and there seemed to be harmonious personalities. Nevertheless, that seems to set the climate for harmonious relations as the testimony has indicated.

It is almost a partnership built up, and the financial arrangements under which they operate seem to be very satisfactory to the scientists in that the technical director even has a responsibility, budgetwise, for the various projects.

The testimony of yesterday would indicate that it might be worth your while having some of your people look into that operation out there and getting a copy of the standard operating procedures that they have established out there.

Whether or not it would work if you had two personalities that did not get along together, I don't know. It probably would not, but in any event the climate has been set by that.

The only other thing I wanted to call to your attention, Mr. Gardner, is the fact that just this week the Secretary of Defense directed that a certain plan be put into operation that I have been working on for 2 years, which might be of some interest to you and you might look into it, which is the mobilization of scientists and technical personnel in the event of war.

Under this plan the Secretary of Defense has authorized G–2 in the Department of the Army to set up a pilot operation to carry out this plan.

What it is, is this: You have a lot of valuable scientists that you know of that you would love to have come into the air research and development in the event of war and they would probably be glad to come in to do it, as in the last war. Under the present plan you have no way of setting up security clearances and you have no way of saying to Dr. DuBridge, "We will bring you in as a GS-16 and will you come in and work with us in the event of war?"

And he says, "Yes."

Then you get advance clearance from the Civil Service Commission and you can offer him that job and bring him in to consult with your people for periods of 2 months to a year and pay him on the basis of when actually employed. You can get his security clearance in advance and you can do it with about 12 of your top scientists in the country and utilize them in the Air Research and Development program at the cost of just one body to you.

As I have said, the G–2 has a great need for these technical personnel in time of war and it might be worth your while looking into it for the purpose of utilizing the services now of some of these top-flight engineers and scientists to help analyze what you are doing, to look into your particular program, because, as I have said, Dr. Hannah has just approved this week a pilot operation for the Department of Defense. I see no reason why it should not work very well in the research and development field.

Mr. GARDNER. I will be very happy to take a look at it.

Mr. RIEHLMAN. Mr. Lipscomb, do you have other questions you would like to ask the Secretary?

Mr. LIPSCOMB. No, sir.

Mr. RIEHLMAN. Mr. McCormack, do you have any further questions you want to ask the Secretary?

Mr. MCCORMACK. No; I had some when he was here before but the other witnesses have testified, which sort of clarified in my mind what I was going to ask him.

Mr. RIEHLMAN. I think that as we go through the transcript and when we have concluded our hearings, if we find, Mr. Secretary, that

there are questions we will have the staff get in touch with you and notify you.

If there are no other questions, I know you are a busy man and we certainly do not want to detain you here this morning.

We will conclude this portion of the hearing and express our appreciation to you for coming up this morning and bringing this additional information.

Mr. GARDNER. Thank you.

Mr. RIEHLMAN. Thank you very much.

We will recess until 2 o clock this afternoon when we will have Major General Uncles of the United States Army.

(Whereupon, at 11:14 a. m. the subcommittee adjourned until 2 p. m., same day.)

AFTERNOON SESSION

(The subcommittee reconvened at 1:45 p. m., Hon. R. Walter Riehlman, chairman, presiding.)

Mr. RIEHLMAN. I will call the subcommittee to order. Let the record show that the gentleman from California, Mr. Lipscomb, and the chairman, Mr. Riehlman, are present, and that Maj. Gen. R. C. Maude, commanding general at the Cambridge Research Center at Cambridge, Mass., is present to testify before the committee.

General, we appreciate your coming down here and giving this committee what information you can about the operation of the Cambridge Research Center, of which you are the commanding officer.

With that introduction we will proceed with whatever statement you have to give to the committee.

STATEMENT OF MAJ. GEN. R. C. MAUDE, COMMANDING GENERAL, CAMBRIDGE RESEARCH CENTER, CAMBRIDGE, MASS.

General MAUDE. I have no prepared statement.

Mr. RIEHLMAN. Then I understand that the staff director, Mr. Balwan, has made a field—I do not know if I want to call it an investigation but at least he has made a field tour of your operation up there.

General MAUDE. Yes, sir.

Mr. RIEHLMAN. And has accumulated some information, and I presume he would like to ask you some questions in respect to that.

Mr. BALWAN. If I might, Mr. Chairman.

Mr. RIEHLMAN. Yes, sir.

Mr. BALWAN. The purpose of our whole inquiry is to determine whether we are using our scientific human resources to an optimum degree. The Cambridge Research Center is one place which is in operation where some controversies have arisen about which you are familiar, and I think it might be good for the record to hear your version of how that has developed.

We could probably start in by having you describe for the members what the mission of the base is, when you arrived there, and what your background has been for this job.

General MAUDE. First, the mission of the Cambridge Research Center is to conduct research development and test in support of the mission of the Air Research and Development Command in the fields of electronics, geophysics, and at the moment, nuclear physics, radio-

biology, and radio chemistry. Another mission is to provide the Air Force support in the administration of Project Lincoln.

Mr. BALWAN. Could you explain what Project Lincoln is?

General MAUDE. Project Lincoln is a project which was mentioned this morning by Mr. Gardner and it is a contract with the Massachusetts Institute of Technology to conduct research and development and otherwise expedite better weapons for the air defense of the United States, primarily for the continental United States, although there are offshoots in other areas, such as improved radar and other things that are components of the air defense of the United States.

Mr. BALWAN. Is it concerned with setting up the approaches of the continental defense?

General MAUDE. It is. Are you talking about the periphery of the United States or farther north? What we are doing in the Far North, I think, is a classified subject, but they are concerned in that project.

To answer the next question, I got to Cambridge and took the command over from General Phillips in the latter part of March 1953, a little over a year ago.

Mr. BALWAN. Could you back up to what other commands you have had prior to that time?

General MAUDE. Yes. I was originally a Signal Corps officer, and when the war broke out I was in headquarters of the Chief Signal Officer in the Munitions Building working on air-defense matters. Radar at that particular time was just beginning to show up as a control device, and such matters as that were under my cognizance in the Chief Signal Officer's office.

At approximately Pearl Harbor I was transferred to the headquarters of the then Army Air Corps, doing the same work since the radar and air defense were transferred to the Chief of the Army Air Corps.

I stayed as head of what was called the Aircraft Warning Division. I went overseas in 1943, after going to a joint school, where I was communications officer for the 9th Bomber Command in England at that time, and then moved soon after the invasion started to the headquarters of the 29th Tactical Air Command, which was in direct support of the Ninth Army. I stayed in that capacity as a colonel with various and sundry titles which added up to communications officer of that command.

Mr. BALWAN. Did this involve research work?

General MAUDE. No. The only connection I had with the research and development was incidental to my job as Chief of the Aircraft Warning Division while in Washington. We were after the research and development people to give us radar and communications equipment, but I was not directly concerned except to try to get the products speeded up.

After the war I stayed as electronic and communications officer of the United States Air Force in Europe until 1947, then came back an became Deputy Commander of the Airways and Air Communications Service. I went to the War College as a student in 1948 and 1949 and from there went for a very short time as Chief of Staff of the Air Defense Command for General Seville, who was commanding it. I stayed there only 2 months and was moved to Washington at the same time General Seville was moved there and became Assistant Director of Requirements. There was three general officers, of which I was

the junior. I stayed there during the period when the new Deputy Chief of Staff for Development was set up, and very shortly after that I was associated with the highly classified project called AFOAT–1, a special project, which was set up in Washington, engaged in intelligence work. I was there 9 months. At that time it was an operational unit but on the fringe of research and development.

I became Director of Communications Headquarters, United States Air Force in Washington in the Pentagon and was there about a year and a half. I moved from there in February 1953 and took over at Cambridge in March.

(Members of the committee, McCormack and Ikard, arrived at hearing.)

Mr. RIEHLMAN. General Maude has just given us a brief summary of his background and experience prior to his assignment at Cambridge. He does not have a prepared statement but Mr. Balwan and another member of our staff had made a trip up to the laboratory and had had a rather lengthy conversation with the general at that time, and Mr. Balwan was just interrogating him about some of the operations, or is about to, in his activities up there.

So if you will proceed, Mr. Balwan.

Mr. BALWAN. In March 1953, you took command at Cambridge Research Center?

General MAUDE. Yes, sir.

Mr. BALWAN. Could you describe to us what kind of organizational setup you had for running the center in terms of your staff people and your civilian people in your laboratory. Do you have an organization chart?

General MAUDE. I do; the one that was furnished to you.

Mr. RIEHLMAN. This chart is dated October 1953.

General MAUDE. Here is one of March 1954.

Mr. RIEHLMAN. October 1953, is when you took over, or prior to that time?

General MAUDE. March 1953; yes.

There was a Command Section including a commander, deputy commander, and technical director. Immediately under the Command Section there was the usual administrative type of staff with an inspector general, staff judge advocate, adjutant, surgeon, and so forth.

The center staff included a deputy chief of staff, comptroller, with a Statistical Services Division, Management Analysis Division, Accounting and Finance Division, and Budget Division.

Under the Deputy Chief of Staff for Personnel there was a Civilian Personnel Division, a Military Personnel Division, and a Ground Safety Office.

Under the Deputy Chief of Staff, Materiel, there was a maintenance, supply, service and transportation officer, an installations staff engineer, and a Procurement Division.

Under the Deputy Chief of Staff for Plans and Operations, there was an Operations Division, a Plans and Programs Division, and a Manpower and Organization Division.

Mr. BALWAN. These staff sections are primarily military operations and are headed up by military personnel?

General MAUDE. All four were headed up by colonels or lieutenant colonels. At that time I do not recall whether the No. 2 man in those were civilians or not.

Mr. BALWAN. That does not make too much difference.

General MAUDE. But they were headed by colonels or lieutenant colonels.

Mr. BALWAN. Your Comptroller, Personnel, Materiel, and Plans and Operations, who headed those up?

General MAUDE. The chief of staff.

Mr. BALWAN. Who was the chief of staff?

General MAUDE. At that time the chief of staff was Colonel Serig.

Mr. BALWAN. Has that changed?

General MAUDE. He has retired.

Mr. BALWAN. Who holds it now?

General MAUDE. The chief of staff and the deputy commander were one and the same, as I recall it, at that time.

Mr. BALWAN. How is it organized now?

General MAUDE. Shall I continue with the rest of this? In the command block we now have a commander and a deputy commander and the chief of staff and a deputy chief of staff, and that is all in that block.

Mr. BALWAN. Can you put that in terms of people?

General MAUDE. The technical director has been removed from that command block by my action. The deputy commander and chief of staff is Colonel Ingelado. The deputy chief of staff is Lieutenant Colonel Gee, G-e-e.

Mr. BALWAN. Does the deputy commander run the Plans and Operations, Personnel, Materiel, and Comptroller?

General MAUDE. For the staff, that is true.

Mr. BALWAN. They are responsible to him?

General MAUDE. Yes.

Mr. BALWAN. Is he a rated officer?

General MAUDE. He is a rated officer.

Mr. BALWAN. Concerning the informal organization, since Colonel Ingelido is a rated officer, and since more than half of the operation is the operation of the Hanscom Air Force Base, would he be the man to head that?

General MAUDE. He was commanding officer of the 6420th Test Support Wing at that base before I brought him to the center.

Mr. BALWAN. But you have given him other duties?

General MAUDE. Yes. We have a wing commander, also, at the base.

Mr. BALWAN. But this Lt. Col. Gee is deputy chief of staff to Colonel Ingelido, and he might be more concerned with operations in Cambridge than Colonel Ingelido as an informal arrangement?

General MAUDE. That is true. As I see the operation and observe it and know for a fact, the coordination of the staff activities, getting the papers out on time, and all that sort of thing, would fall more to Colonel Gee than Colonel Ingelido.

Mr. BALWAN. The chain of command at Cambridge is from commander to deputy chief of staff to plans and operations, materiel, personnel, and comptroller?

General MAUDE. That is true, but I do not think you should cut Colonel Ingelido out of the picture quite that much. He is very definitely concerned with the operation of the station. However, many of the details Colonel Gee handles without reference to him unless there are difficulties.

Mr. BALWAN. Could you bring us down to the actual line functions of the center?

General MAUDE. Yes. That is the staff part of the center organization. We now come down to what I would call the operating directorates that consist of geophysics research, electronics research, atomic warfare, and 6520th Test Support Wing, headquarters at Hanscom.

Mr. BALWAN. That is a support wing and also a staff organization?

General MAUDE. That wing is primarily responsible for all our support activities, the operation of them, not the staff part of it. Their staff is to run the wing and not to run the center.

Mr. BALWAN. They are a service organization?

General MAUDE. They are a service organization.

Mr. BALWAN. Because the principal mission of Cambridge is not to operate a base and fly planes?

General MAUDE. That is true.

Mr. BALWAN. And they are to provide the services called for by the laboratories and the Lincoln project?

General MAUDE. The flying and the operation of a radar net we operate for the support of Lincoln, to feed information into various devices that Lincoln is building. They run that too, as support. They operate it out of the wing. The aircraft warning and control squadron, they call it.

Mr. BALWAN. Have you finished naming the directorates?

General MAUDE. There are three directorates and a support wing. The three directorates are geophysics research directorate, electronics research directorate, and atomic warfare. Within the directorates we have various and sundry laboratories. I can name them.

Mr. BALWAN. I do not think that is necessary at this point. Who was in charge of each of the directorates when you came to Cambridge?

General MAUDE. When I came to Cambridge the director of the geophysics research directorate was Dr. Landsberg. Dr. Schneider was director of the electronics research directorate. Colonel Jack was director of the atomic warfare directorate. And Colonel Ingelido commanded the 6520th Test Support Wing.

Mr. BALWAN. Have you mentioned that when you came there you had a technical director who was up in the——

General MAUDE. In the command block.

Mr. BALWAN. Could you tell us who he was and what his functions were, as you inherited them?

General MAUDE. Well, his job description we furnished you with It is quite a long thing.

Mr. BALWAN. Do you have that here?

General MAUDE. I have a copy of it here; yes, sir.

Mr. BALWAN. Could you inform the members of what his job description was? Is it all right to ask that question, Mr. Chairman?

Mr. RIEHLMAN. Yes, certainly.

Mr. IKARD. Mr. Chairman, before we get into the job description may I ask a couple of questions?

Mr. RIEHLMAN. Yes, sir.

Mr. IKARD. General, if what I ask is repetitious will you tell me, because I did come in a little late.

How flexible is this organizational chart you have been talking about? I mean by that, to what extent do you as commander change

it or vary it from its existence there? How much latitude do you have?

General MAUDE. I would say on my own I have very little latitude to change that, without going to Baltimore, Baltimore being the headquarters ARDC.

Mr. IKARD. Yes, sir; I know that. Assume you made a recommendation to Baltimore as the commander. Would it usually be followed? As a general rule, unless there were some major change would it be followed? I do not mean you personally, but I mean the commander.

General MAUDE. Yes, sir.

Mr. IKARD. That would generally be followed?

General MAUDE. Yes, sir; if they were not too major.

Mr. IKARD. I am not talking about you personally, General.

General MAUDE. I understand.

Mr. IKARD. I am talking about whoever might occupy the command.

General MAUDE. If it was not too major; just a very minor shift. A telephone call I think would get it approved. If it involved more manpower or more people or more money it would have a slim chance of being approved.

Mr. IKARD. Assuming that it cost no additional money and required the use of no additional manpower, the commanding general could do that?

General MAUDE. He has some latitude. Quite a bit of latitude.

Mr. IKARD. He has, directly or indirectly, through this Baltimore procedure, considerable latitude in shifting responsibility and changing the internal organization?

General MAUDE. If it is not too major.

Mr. IKARD. I understand you could not change that.

General MAUDE. For example, if I were to attempt to abolish, we will say, the test support wing, and do it in some other fashion, that would be looked at.

Mr. IKARD. I understand. But I mean the organization within the established sections.

General MAUDE. Quite considerable latitude.

Mr. IKARD. Yes, sir. Thank you, Mr. Chairman.

Mr. MCCORMACK. When you recommend to Baltimore, who passes upon it, General?

General MAUDE. If it is an organizational matter, sir, it would go to Baltimore through our Manpower and Organization staff people, go down to them to a corresponding office in Baltimore, and then the final decision on it, if it were very major, I am sure, would be made by the commander or his deputy.

Mr. MCCORMACK. In other words, it would go from military to military?

General MAUDE. It would go from military to military.

Mr. BALWAN. Was any change involved in bringing Colonel Ingelido from the wing?

General MAUDE. As a movement of an individual?

Mr. BALWAN. Yes.

General MAUDE. No. I discussed that before doing it with my boss, who was at that time General Putt.

Mr. BALWAN. Did it mean any kind of change in that block upstairs with you?

General MAUDE. No; it did not because the position was vacated when Colonel Serig retired.

Mr. BALWAN. I see.

General MAUDE. Colonel Serig retired for statutory reasons in June a year ago; I believe June 30, after 30 years of service. When he retired that left his vacancy. I moved Colonel Ingelido in to fill that vacancy shortly thereafter. I do not remember the exact date.

Mr. BALWAN. Following up Mr. Ikard's question, which is very apropos: Have you ever in your experience been handed a change which was initiated by the upper echelon for your command?

General MAUDE. Change in organization?

Mr. BALWAN. Yes. Or does that usually come as a recommendation from below, the commander himself?

General MAUDE. I do not recall since I have been there of anything of any major importance being handed to me.

Mr. BALWAN. The point I am trying to make is that in our discussions, Mr. Chairman, they tell us that no changes are possible unless they get concurrence from the top, but since top never makes changes below except upon recommendation from below most of the changes that are made are upon the recommendation of each new succeeding commanding officer. He expresses the philosophy as to how he wants that base run. Then he has to get approval for carrying out the philosophy for operating that base. Is that not about right?

General MAUDE. That is right. In the case of the electronics directorate last summer there was some question raised by outsiders on the course of a normal staff visit, and so forth, about the organization of the electronics directorate. I did at that time ask that they send somebody up and give me the benefit of an outside look at that organization. They came up with the same thing we had when they got through.

Mr. BALWAN. Could you go back and tell us how it was organized when you came there and inherited the position; unless some others have some questions first?

Mr. RIEHLMAN. I think that is very pertinent at this time, that you find out how it was organized when you came in.

General MAUDE. The way it was organized is practically the same as it is organized now, as I recall.

Mr. BALWAN. It was organized the same way when you arrived as it is now?

General MAUDE. I have not changed that at all.

Mr. RIEHLMAN. You have not changed the organization?

General MAUDE. No, sir; of the Electronics Research Directorate.

Mr. BALWAN. No; I mean of the total organization. You inherited a deputy director?

General MAUDE. I beg your pardon. I have the wrong chart.

Mr. RIEHLMAN. You have the wrong chart.

General MAUDE. The only changes from this chart to this one, as far as I can tell——

Mr. IKARD. Mr. Chairman, if I might interrupt; could he identify those charts for the sake of the reporter?

Mr. RIEHLMAN. The first is in the record as the chart for 1953, when he came in.

Mr. IKARD. I mean, could he refer to them as the "1953 chart" to make sense here?

Mr. RIEHLMAN. That is the one he will explain first, and then he will go to 1954.

General MAUDE. This is the chart of March 1954.

Mr. RIEHLMAN. You have one for 1953, too, that the recorder has here now.

General MAUDE. This is 1954.

Mr. RIEHLMAN. This is the 1953 chart right here.

General MAUDE. I think the dates are on the bottom.

Mr. RIEHLMAN. Yes, but we will put it on here. That was the original framework under which you were operating when you came in as commander at that laboratory; is that right?

General MAUDE. That is right.

Mr. RIEHLMAN. All right.

Mr. BALWAN. Could you explain then, for the purpose of the record, what that is, since the recorder cannot get anything except what you tell him?

General MAUDE. The only difference between these 2 charts, the 1 for 1953—this is the 1 for October 1953—and the chart for March 1954, is up in the command block.

Mr. BALWAN. Is the 1953 chart, which is for October 1953, substantially the same as it was in March 1953, when you arrived?

General MAUDE. Substantially the same. I do not have a chart of when I arrived, but it is substantially the same.

Mr. BALWAN. Did you inherit an organization which had a civilian who was heading up the laboratories or the directorates?

General MAUDE. I did. The research directorates—geophysics directorate and electronics research directorate—were both headed by civilians when I took over.

Mr. BALWAN. Did you have a man in the office of the commander?

General MAUDE. There was a technical director when I took over in the office of the commander.

Mr. BALWAN. Did the technical director you refer to have a title of technical deputy when you arrived?

General MAUDE. I believe that was his title when I arrived.

Mr. BALWAN. He was a technical deputy?

General MAUDE. That is right, sir; I believe.

Mr. BALWAN. During the course of your administration, after you arrived, did you change the title from technical deputy to technical director?

General MAUDE. I did. At the time—I do not recall, but it was roughly July 1, at which time several of these titles changed. For example, in conformance to an Air Force directive the titles were made uniform throughout the service.

Prior to that time, approximately July 1, 1953, I was called the commanding general. I am now called the commander.

Mr. BALWAN. That did not change your functions, but changed the title?

General MAUDE. It did not change functions; just a change in names. At the same time, the Air Force directive spelled out various titles we could have. It was my understanding, as I remember it, it had to be a technical director to comply with those standard forms that were given us.

Mr. McCORMACK. You got instructions from above, then?

General MAUDE. It came from above.

Mr. McCORMACK. That gets back to the question before.

General MAUDE. That is right. It was not aimed directly at this place, or any other place.

Mr. BALWAN. You were instructed to change the title from technical deputy to technical director?

General MAUDE. I was not instructed to do it. Whether it was a regulation or what it was that came down from up above, it gave us the standard titles to be used in all types of organizations. It eliminated, for example, the title of deputy or vice commander for the wing. We had to call him thereafter an executive instead of a deputy commander.

That was effective throughout the Air Force, for standardization. I was not directed to. In fact, this particular directive from above had nothing to do with a technical director or a technical deputy; but I changed the name of my own violition at that time.

Mr. BALWAN. Was there any reason for changing the name from a deputy to a director?

General MAUDE. I figured that it came nearer to complying with the spirit of this particular directive we got.

Mr. BALWAN. What were the duties of this technical deputy when you arrived? You had a job description; or did you have a question which you wanted to ask, here, Mr. Chairman.

Mr. RIEHLMAN. Not at this point. I would like to have him finish this.

General MAUDE. This is a copy of the job description of the technical director. It is called a technical director here, I notice.

Mr. BALWAN. What is the date of that?

General MAUDE. This is a copy of July 8, 1952, signed by General Phillips. Actually, there is another date down here, but this is signed by General Phillips. This is when I took over and it still remains the same. I did not change it.

Mr. BALWAN. Could you read us in substance what his duties were as you understood them to be?

General MAUDE. I will read this.

Mr. BALWAN. You are familiar enough with that. Do you know?

General MAUDE. Yes. In general the technical director is directly responsible to the commanding general for recommendations of adequate policies and procedures for directing, evaluating, and coordinating the scientific research program to meet specific Air Force objectives. Now, I think the rest of it amplifies that:

> Based on a broad knowledge of Air Force requirements, current trends in both fundamental and applied research in electronics, physics, meteorology, mathematics, and related specialized fields of physical chemistry and engineering, works closely with Air Force Headquarters, or the Air Force in general, ARDC, and AFCRC research planning staffs in establishing basic objectives.

Mr. BALWAN Mr. Chairman, I think this is an important enough document to establish what the work is of a civilian scientist or a civilian director that it might be worth reading, in my own opinion. I will leave it up to you.

Mr. RIEHLMAN. I think it would be well, as long as that is a directive that came down from General Phillips in respect to the responsibility that is placed upon a director in that field of activity. That would

once and for all establish, apparently, what qualifications a man should have to fill that position. If you could read it into the record I think it would be helpful.

General MAUDE. There is no reason at all not to, sir.

Mr. MCCORMACK. General Phillips was your predecessor?

General MAUDE. That is right, sir. I did not change that.

Mr. MCCORMACK. You have followed, so that means you have approved this memorandum?

General MAUDE. Yes, sir.

Mr. MCCORMACK. All right.

General MAUDE. This is a copy of a civil service form which spells out the job description of this individual or any other individual for his particular job. They are all the same form. This is the one in the case of this technical director, however.

Mr. BALWAN. A job description, however, even though it is a civil service form, is something devised by the commanding officer to fulfill the mission at the base?

General MAUDE. That is right. It is provided by the supervisor of the individual upon whom the job description is made. General Phillips was his immediate supervisor.

Mr. BALWAN. Can you proceed, then?

General MAUDE (reading):

Programs are initiated which are the result of proposals from the center's subject matter specialists, advice from expert consultants and directives from headquarters, ARDC and USAF. Collaboration with other research agencies (private and governmental), in the form of joint projects, is not uncommon. Recommendations furnished the commanding general are based on a continuous and careful scrutiny of work being done in the scientific areas under investigation (both here and abroad), available in-house and contract talent and facilities, time factors, and so forth. Determines whether supporting programs are adequate.

Reviews and evaluates the scientific effort of the three research divisions (Electronics, Geophysics and Atomic Warfare) and recommends to the commanding general initiation of, additions or deletions to, changes in emphasis on, and discontinuation of research projects.

Establishes and maintains professional contacts at the highest level in order to keep informed of research and development trends in areas of research within the center's interest, as well as to secure the support and cooperation of academic and industrial laboratories.

Actively shares in the compilation of supporting material for the defense of the center's research and development programs. The planned program for fiscal year 1953 is $40 million.

The program of the Cambridge Research Center represents research, development, and testing in the fields of electronics, physics, meteorology, mathematics, physical chemistry, radiobiology and radiochemistry. Advancement in fundamental understanding and knowledge in these fields is essential to the welfare and security of the Nation. The scientific effort at this center resulting in improved air weapons.

Scientific objectives of the Air Force are geared to current and predicted needs. Programs in support of these objectives are jointly conceived by the Air Force, ARDC, CRC—

That is Headquarters, Air Force, talking about Headquarters, ARDC; and CRC is the Cambridge Research Center—

recognized authorities and consultants. No standard guides exist for planning, guiding, and evaluating such activities. The commanding general furnishes guidance and has final responsibility on implementation of such programs through establishment and operation of support organizations.

Vision, scientific acumen, and judgment are essential to this position. Leadership in the highest sense is required to organize and guide the effort without hampering original ideas or otherwise creating an atmosphere which is not conducive to bringing forth the highest level of scientific effort.

Represents the center at planning conferences at ARDC, Air Force, and other agencies. Defends and explains own ideas and recommendations. Decisions frequently require considerable insight into controversial matters.

Mr. BALWAN. This is a pretty important job, from the job description.

General MAUDE. It certainly is; yes, sir.

Mr. BALWAN. Who was the man who had this position when you arrived?

General MAUDE. Mr. John W. Marchetti.

Mr. BALWAN. Did his duties change at all after he became a technical director, from being technical deputy?

General MAUDE. To my knowledge not at all.

Mr. BALWAN. How long did he hold that job?

General MAUDE. He held that job until December, last December.

Mr. BALWAN. Of 1953?

General MAUDE. 1953.

Mr. BALWAN. What happened then?

General MAUDE. At that time I abolished this position.

Mr. BALWAN. For what reason?

General MAUDE. Because over the period of time that I had had the center—that is, from March until December—over that time I began to have misgivings as to the ability of Mr. Marchetti to fill a job like this, or the ability of anyone that we could get, within the pay scale we are authorized, to have a background sufficiently broad and detailed in the 3 fields that I have discussed, electronics, geophysics, and atomic warfare; because there is very little correlation or overlap between those 3 fields. Each is more or less a complete field in itself.

As time went on between March and December I was beginning to question whether Mr. Marchetti was doing all this.

Mr. BALWAN. Did you question the need for having such a position, aside from the personality in that position?

General MAUDE. No; that did not occur to me at first.

Mr. BALWAN. You could have just vacated the position by firing Mr. Marchetti and could have left the position there hoping that some time you could fill it?

General MAUDE. I could have done that, but I talked with lots of people outside the center, lots of scientific people. It became to me increasingly evident that our ability to find a man who could do all this in those three fields—we would not get him. We could not get him. We could not hope to get him.

Mr. BALWAN. It was more than just getting rid of a person?

General MAUDE. That is right.

Mr. BALWAN. You chose to abolish the position?

General MAUDE. That is right.

Mr. BALWAN. Who would give you the information from that point on which was being provided for you up to that point?

General MAUDE. If I wanted to find out what was going on in geophysics I had to go to the Director of Geophysics to get that information.

Mr. BALWAN. You had to when Mr. Marchetti had that information?

General MAUDE. That is right.

Mr. BALWAN. You had to then?

General MAUDE. If I wanted it in atomic warfare it was Colonel Jack who was the Director of Atomic Warfare.

Mr. BALWAN. How can you run an establishment this large and have the time to do all this kind of work?

General MAUDE. Well, I do not go into the details of all these unless there is a controversy on a very major subject under consideration.

Mr. RIEHLMAN. I wonder if I could go back to just what the General is explaining here. When Mr. Marchetti was in charge up here as a deputy he had the responsibility over these three divisions down here—is that correct?

General MAUDE. That is correct, sir; technical.

Mr. RIEHLMAN. Technical; that is right. If I understand the job assignment and the qualifications that the man should have to fill this position up here, he should be in a position to give you any information about the operation of any one of these activities on the three levels.

General MAUDE. That is right, sir.

Mr. RIEHLMAN. Am I correct?

General MAUDE. That is right, sir.

Mr. RIEHLMAN. But you are telling the committee that even when he was filling the position he was not capable, apparently, of giving you this information, so you had to go directly to the heads of these different departments.

General MAUDE. I found myself having to do that more and more as I got more and more into the picture.

Mr. BALWAN. Mr. Marchetti, as I understand it, is a technician in electronics.

Mr. RIEHLMAN. That is right.

General MAUDE. Well, I was going to add that. As time went on it became apparent to me, in my judgment, that Mr. Marchetti was nothing but another director of electronics.

Mr. BALWAN. Did you still have to go to the electronics people to get information?

General MAUDE. I could get information about electronics from Mr. Marchetti very nicely.

Mr. RIEHLMAN. But you say he had no experience in geophysics or in atomic warfare?

General MAUDE. Or atomic warfare.

Mr. RIEHLMAN. In either of those fields?

General MAUDE. I do not know if he had any experience. He had some knowledge, but he was not anywhere near as proficient in it as the two heads were down below.

Mr. RIEHLMAN. I see. He was not capable of furnishing you with technical information about the operation of either of those departments?

General MAUDE. That is right, sir. I went further and went on 2 or 3 occasions to the Director of Geophysics, Dr. Landsberg, and to the Director of Atomic Warfare, Colonel Jack, and asked them pointblank how much supervision, guidance, et cetera, which was mentioned in here, they were getting from the technical director, and the answer was, "Practically zero."

Mr. BALWAN. But he is not doing so much guidance of the program as he is coordinating and advising the commanding officer. A man

at that level, as technical deputy or director, would not necessarily be in the operations of the directorates, would he?

General MAUDE. Well, not directly messing—not "messing up"—down within the organization trying to direct various individuals, if that is what you mean, Mr. Balwan. No; I would think not. That would be just as wrong on the other side.

Mr. BALWAN. As it is now, in the absence of that man you are not giving them guidance either, are you?

General MAUDE. No.

Mr. BALWAN. Because you are not a geophysicist or atomic energy man or an electronics expert.

Mr. RIEHLMAN. Let us try to clarify this in my thinking, at least. This gentleman certainly could not go down and see that the operations in all of these three departments were carried out properly, but, as I understand his function, information about the operations of these three different departments was to flow through his office and he would evaluate what was going on.

General MAUDE. That is right.

Mr. RIEHLMAN. To be able to evaluate what was going on in these three departments and keep you advised.

General MAUDE. Yes.

Mr. RIEHLMAN. As commander of that research center, as to exactly what was being accomplished?

General MAUDE. That is right, sir.

Mr. RIEHLMAN. At these levels.

General MAUDE. That is right, sir. Also, in addition he was, you will recall, to represent the center, I believe it says in there, at various and sundry technical meetings at other places in these fields.

Mr. RIEHLMAN. Yes. Let us go one step further. After you got in here and you had made a study of it, apparently you had some evidence given to you that this gentleman who was holding this position was not capable of evaluating in these two fields, particularly in geophysics and atomic warfare, as to what was going on down there; is that a fact?

General MAUDE. That is right, sir; and guiding them.

Mr. RIEHLMAN. And then instead of suggesting to the gentleman the disposing of his services, what you did, apparently, was to abolish the job?

General MAUDE. I abolished the job and did some other things, sir.

Mr. RIEHLMAN. I want to follow through on this, if I can.

General MAUDE. Yes, sir.

Mr. RIEHLMAN. Now, with the elimination of his position, you have no one, apparently, at that level with a scientific background or with the qualifications which are called for in this document, which your predecessor had established, who can fill you in on the operations that are going on down there, and you have to go directly to the heads of each one of these directorates?

General MAUDE. That is not exactly true, sir.

Mr. RIEHLMAN. Let us understand what is true.

General MAUDE. I have the chart of 1954. Also added to this chart is the AFCRC Steering Committee.

Mr. BALWAN. This action was taken after you abolished the job?

General MAUDE. This was taken at the same time, at the same time the job was abolished.

Mr. RIEHLMAN. Yes.

General MAUDE. Also, another action was taken to increase the planning and programing ability of the Plans and Programs Division, by moving a GS–15, who had at one time worked for Mr. Marchetti—had been moved out of that office over into the Plans and Programs Division, where all the plans and programs of the center should get bound together to see that they conform with guidelines from above as to the amount of money on a particular project, as to its priority, et cetera. I established the Cambridge Research Center Steering Committee.

Mr. BALWAN. Composed of whom?

Mr. IKARD. If I might interrupt, Mr. Chairman, I would like to hear a little about that committee and about its functions.

General MAUDE. That is what I was about to do, sir.

Mr. RIEHLMAN. He was about to give it to us.

Mr. IKARD. All right; fine.

General MAUDE. I am sorry to take so much time.

Mr. RIEHLMAN. That is all right, General.

General MAUDE. The function of the Cambridge Research Center Steering Committee and I read:

> The Air Force Cambridge Research Center Steering Committee is responsible for establishing the research and development policies of this center. It will review the research and development programs to determine scope, adequacy, and effectiveness, and will resolve any program differences. The committee will determine consolidations, deletions, revisions or expansions in the program that may be required or desirable.

Then there is an Air Force Cambridge Research Center Headquarters Office Instruction which outlines the procedures of the committee.

Mr. IKARD. What is the membership on the committee?

General MAUDE. The membership on the committee is the commander, the deputy commander, the Director of Geophysics, the Director of Electronics, and the Director of Atomic Warfare.

Mr. IKARD. How often did that committee meet?

General MAUDE. It is spelled out here:

> The committee will meet regularly on alternate Wednesdays. Special meetings will be called as required by the business of the committee.

Mr. IKARD. That is all, Mr. Chairman.

General MAUDE. Also established was this permanent secretary of this committee, who was a civilian, a GS–15, in the Office of the Plans and Programs Division.

Mr. BALWAN. May I ask a question there?

Mr. RIEHLMAN. Yes.

Mr. MCCORMACK. How long was Mr. Marchetti in the position of technical deputy before you came to Cambridge?

General MAUDE. Before I came to Cambridge, sir?

It was in 1952, I believe, sir. I do not know the exact date. He was the Director of Electronics prior to becoming that. General Phillips appointed him into this position, I believe in 1952 or late in 1951, sir. I am not positive of that. That is the order of the time.

Mr. MCCORMACK. Have you any idea how long he was at Cambridge?

General MAUDE. Mr. Marchetti has been at Cambridge since 1947 or 1948.

Mr. McCormack. He served under General Phillips. What other commanding officers were there at Cambridge prior to General Phillips, whom he served under?

General Maude. He served under a number ot them, sir. He was there at the time it had another name besides "Center." At one time, back in 1946 and 1947—I have in general the timing on that—it was established as the Cambridge Field Station working out of the Watson Laboratories in New Jersey. It was a field station, entirely electronics. That was right after the war; shortly after the war.

Its commander then was a Major Fletcher.

He had another commander, a Colonel Mitchell. That was also when it was a field station under Watson Laboratory in New Jersey.

Then it changed its status; Cambridge, not Marchetti. Cambridge changed its status from a field station under Watson Laboratory in New Jersey. This was in January 1948 approximately. It was separated from Watson and was assigned direct to the AMC, the Air Materiel Command. This was prior to the formation of the Air Research and Development Command. The Air Materiel Command had as one of its functions research and development.

It now was another separate station, with nothing but electronics in it, assigned to AMC. Then the station became a center.

Mr. McCormack. What year was that?

General Maude. That was approximately June of 1951. I have only the date of the general order that made Colonel Hugh Mitchell the commander of the center as it is now called. Colonel Hugh Mitchell was made commander June 28, 1951. He retired in July. He was there as the commander before that, but this was just a general order changing the name of the unit. The commander stayed the same.

Mr. McCormack. You said you talked with a lot of scientists before you took action on Mr. Marchetti; is that right?

General Maude. That is right, sir.

Mr. McCormack. Was your judgment, to a great extent, dependent upon what these scientists told you?

General Maude. Yes. Well, the first persons I talked to were the heads of the other directorates. How much good were they getting? Were they getting supervision or were they getting any good out of that office? The answer, as I have already indicated, was "No."

Then I talked to people in Lincoln. I just talked over the situation with them. And I have since talked to several others. They felt the same as I did, sir.

Mr. McCormack. To whom did you talk, General?

General Maude. I talked with Dr. Hill, Dr. Valley—and just recently I talked with Dr. Kelly of Bell Laboratories.

Mr. McCormack. I mean, before you took the action you talked with Dr. Hill and Dr. Kelly and who else?

General Maude. Valley. V-a-l-l-e-y.

Mr. McCormack. Valley.

General Maude. Not "hill and valley" with any connotation.

Mr. McCormack. Anyone else?

General Maude. I am trying to think, sir. I talked with my own boss about that time, General Putt.

Mr. McCormack. Was this technical deputy the highest civilian employee at the center?

General MAUDE. That is right, sir.

Mr. MCCORMACK. I see. That is what I wanted to establish. I am not so much concerned about personalities between two individuals, but other things.

Now, you are the commanding officer. The next is your deputy, and the next two in command are military officers? The next two in line?

General MAUDE. Well, the commander and the deputy; that is the end of the command line, unless both of us are away, and then we take the senior military officer, whoever he may be.

Mr. MCCORMACK. Now, the technical deputy, without regard to his name, whoever it is, was the highest civilian at the center?

General MAUDE. That is right, sir.

Mr. MCCORMACK. The "deputy" signifies his position. He had some authority to represent the civilian viewpoint, I suppose?

General MAUDE. That is right, sir.

Mr. MCCORMACK. Working in cooperation with one another. Under the present setup now who is the highest civilian?

General MAUDE. The highest civilian?

Mr. MCCORMACK. Yes.

General MAUDE. There are now two; the two directors.

Mr. MCCORMACK. In other words, they were there anyway?

General MAUDE. They were there anyway; that is right, sir.

Mr. MCCORMACK. So the technical deputy was above them?

General MAUDE. That is right, sir.

Mr. MCCORMACK. So when you abolished that position you went down one step so far as the civilian contacts or working relationship with the military is concerned?

General MAUDE. Yes, sir.

Mr. MCCORMACK. Do you think that was a wise step to take?

General MAUDE. Well I thought so, sir.

Mr. MCCORMACK. Do you think so now?

General MAUDE. I do; yes, sir.

Mr. MCCORMACK. In other words, you think that should exist in any of the laboratories of the Air Force?

General MAUDE. If we had only one laboratory, sir, one directorate, shall we say, I would not agree with that. I think that there should be a senior civilian. In other words, if this were just an electronics laboratory, and electronics directorate, there should be a top civilian.

My point was that we could not get a top civilian who was really tops in all three of those branches.

Mr. MCCORMACK. Did you try to?

General MAUDE. No, sir; I did not go out and try to. That was the line of conversation with some of these other people. Like I say, with Dr. Hill: "What kind of a chance do we have of getting that?"

Mr. MCCORMACK. Did these doctors recommend to you that the position be abolished?

General MAUDE. No, sir; that is my own decision.

Mr. MCCORMACK. Their conversations with you were——

General MAUDE. Not on the individual, nor were they on the office itself; but, having such an office, what kind of a chance do we have to get a man who can do all that?

Mr. MCCORMACK. Did they tell you that Marchetti was not qualified to do the job?

General MAUDE. No, sir; I do not think anybody told me that.

Mr. MCCORMACK. I am just pursuing this and wondering why you abolished the position in a working organization like this, where we want teamwork and where we have two groups which really are as opposite as any two groups in the world can be; both groups honest and sincere, but one subject to discipline, as you must be, and those in the services are.

General MAUDE. Yes, sir.

Mr. MCCORMACK. Profoundly respecting the other as individualistic as any group that probably exists in the human race, which requires an awful lot of understanding, to have them work together, even where there is good faith on the part of both. It requires the greatest of tact, particularly at the administrative level, both the military and civilian administrative level.

General MAUDE. Yes, sir.

Mr. MCCORMACK. I have no thoughts, but I was just exploring as to why the level on the civilian side should not be as near as possible to the high level on the military side. I realize they cannot put somebody in as an opposite to you, but it should be as close to you as is possible, as a very important bridge, with two understanding minds constituting a bridge, with one on the military side.

We are talking now about the scientists; we are not talking about the stenographers.

General MAUDE. Yes, sir; I understand.

Mr. MCCORMACK. That is no reflection on them, but we are talking about the scientists, who are a very important element, a very important group, but an exceedingly individualistic group. That is correct, is it not, General?

General MAUDE. That is right, sir.

Mr. MCCORMACK. Where psychology plays a very important part. We are all concerned with the maximum production in the national interest of our country. That is the objective.

General MAUDE. Yes, sir.

Mr. MCCORMACK. That is the whole objective, to bring that about.

I was wondering why the position was eliminated, rather than bringing the problem to Washington and having them give you authority to classify the position in a manner where if you did not have the right man from the angle of qualifications you could go out and get the right man.

General MAUDE. Well, it was the consensus of the people I talked to that we could not get such a pay increase to attract people of that type.

Mr. MCCORMACK. Well, you did not try, did you?

General MAUDE. I did not go after it; no, sir.

Mr. RIEHLMAN. Could I ask one question at that point, Mr. McCormack, if you would yield?

I am just wondering, General, if it would be so necessary to get a man who is equally qualified in all three fields of activity. I think if you had a man with a background in science who could evaluate what the top men in each one of these departments could inform him on, as to what was going on, that he would have some ability, certainly, to give you information. I would be inclined to agree with you that to go out into the field and pick up a man who is an expert in atomic

warfare and a man who is an expert in electronics and also in geophysics would probably be a big job.

General MAUDE. Yes, sir.

Mr. RIEHLMAN. But a man who had had experience in the field of science in any one of these activities, and had had some experience in managing an electronics research program, should be able, with the assistance of the men at the top of each one of these departments, to evaluate what goes on down here and to be in a position to keep you as the Director, or anyone else, properly informed of what the scientific program really is and what progress is being made.

As I say, I am not a scientist, but I am just trying to use commonsense in the approach to it, to see whether or not that would not have been a far better way.

General MAUDE. Yes, sir.

Mr. RIEHLMAN. Rather than eliminating the position and then putting it directly under the military and setting up here another group who will be composed mostly of all military people, except for these two down here.

General MAUDE. Well, at the moment this gentleman in the atomic warfare is a colonel.

Mr. RIEHLMAN. Yes.

General MAUDE. That does make it that way.

Mr. RIEHLMAN. Yes, it does.

General MAUDE. But in setting up the steering committee in March—March 31 I think is the date; I know that is the date of the document I just read—and bolstering up the Plans and Programs Division of our Deputy Chief of Staff for Plans and Programing—I planned on doing that. I am doing it now that way.

Mr. MCCORMACK. If you got a qualified man, would you revise that position?

General MAUDE. I do not think so, sir.

Mr. MCCORMACK. Do you think that you could get a man——

General MAUDE. Not unless this method I am now using indicates that it is not working.

Mr. MCCORMACK. Now, the reason the position was abolished was because the occupant was a good qualified electronics man, but you did not think that he was qualified in geophysics and atomic warfare?

General MAUDE. That is right.

Mr. MCCORMACK. It is rather difficult to get anyone profoundly qualified in all three of them?

General MAUDE. Extremely so, sir, yes.

Mr. MCCORMACK. Usually you can find a man who is qualified in one, and has had a related experience in the others, particularly in an administrative position; is that not so?

General MAUDE. Yes.

Mr. BALWAN. I think that I remember testimony of yesterday or day before where the military themselves do not apply that criterion to their own regulations and organizations, to the extent that they do not even ask you to be qualified in geophysics or atomic energy and electronics in appointing you the commander of the base; is that correct?

General MAUDE. That is probably true, sir. I do not know what was applied to me when I went up there. That I would say is true.

Mr. BALWAN. We are talking about this business, this military control.

General MAUDE. Yes.

Mr. BALWAN. We received testimony, I think, Mr. McCormack, which said that it is not necessary for the officers to be expert in those fields in order to direct those programs, in order that the programs might be responsive to the methods of the military.

Mr. MCCORMACK. We got testimony that it would be poor procedure to take a man who never had any experience in any of the fields related to science such as engineering, and so forth, and put him into the field of technical research. In other words, take a man from a ship who has been in the Navy. It would not be all right to put him in command of a laboratory, but it would be all right under the rotation system to have a man who had been in engineering and electronics put into a laboratory. Then you could put him out into the field where he would still be in related activities but getting practical experience in application of the laboratory work, and later you could bring him back into the laboratory. You would have a continuity of a career act vity which would be related to the field of technical research, any one of its four aspects—basic, applied, engineering, and production.

We had very strong evidence in that respect from a high-ranking officer of the Navy, and I think it is pretty generally considered that it is concurred in by other branches as far as the military is concerned.

Mr. LIPSCOMB. What happened to the duties required in this directive here in qualifications?

General MAUDE. I built up the plans and programing part of my Deputy Chief of Staff, Plans and Operations.

Mr. LIPSCOMB. Is he a scientist?

General MAUDE. He is a GS–15. He is a civilian and a permanent secretary of the steering committee that I just talked about.

Mr. LIPSCOMB. Is he a scientist?

General MAUDE. He is a graduate of the Massachusetts Institute of Technology and would be classified as a scientist, I believe.

Mr. LIPSCOMB. In this first qualification?

General MAUDE. A science administrator I would say would be more his title.

Mr. LIPSCOMB. In the first qualification it says:

> Technical deputy at this center is directly responsible to the commanding general for the recommendation of adequate policies and procedures for directing, evaluating, and coordinating the scientific research programs to meet these specific Air Force objectives.

Who does that?

General MAUDE. The steering committee. It is done by the three directorates within their field and it is envisioned that our steering committee should review these things and pass upon them.

Mr. LIPSCOMB. But you are a member of the steering committee.

General MAUDE. I am a member of the steering committee.

Mr. LIPSCOMB. So that leaves two civilian scientists and another military man?

General MAUDE. A military scientist.

Mr. LIPSCOMB. You are the Deputy Director. Does the review committee review and evaluate the scientific effort of the three research divisions?

General MAUDE. Yes; on such things as budget matters, financial plans, and manpower.

Mr. LIPSCOMB. This puts them in the position of reviewing and evaluating their own efforts, then?

General MAUDE. They are doing it jointly. I am still going to be responsible for making the final decisions on whatever is recommended.

Mr. LIPSCOMB. Then it says:

> This Deputy Director here actively shares in the compliation of supporting material for the defense of the research and development programs.

Now, each of these various branches prepares its own information in that regard with no one to evaluate it; is that right?

General MAUDE. We get directives from higher headquarters regarding all of our projects.

Mr. BALWAN. To whom do those directives go specifically when they go to Cambridge?

General MAUDE. They go to this office in Plans and Programing.

Mr. BALWAN. Who heads up Plans and Programing?

General MAUDE. Colonel Adams is the head of Plans and Programing, the Deputy Chief of Staff.

Mr. BALWAN. He is a military man?

General MAUDE. Yes, and the deputy to him is a civilian who is also the permanent secretary of the steering committee.

Mr. BALWAN. We discussed the staff part of this thing as a military function responsible by the informal organization or otherwise, to the Deputy Chief of Staff, and to you?

General MAUDE. And to me.

Mr. BALWAN. The duties of the committee have taken over some of the duties which Mr. Marchetti had?

General MAUDE. That is right.

Mr. BALWAN. The Deputy Chief of Operations is a staff function which, as established earlier, is military, and therefore responsible to the Deputy Chief of Staff, who would be Colonel Gee in your organization?

General MAUDE. Yes; responsible to this block [indicating].

Mr. BALWAN. That block is primarily military now, is it not?

General MAUDE. Yes.

Mr. BALWAN. To some extent, we have taken a civilian out and put this more under the control of military personnel; have we not?

General MAUDE. I do not see it that way because the steering committee can get at it.

Mr. BALWAN. Also, the steering committee is responsible to the commanding general.

General MAUDE. I had it anyhow regardless of whether there is a civilian in the block or a steering committee that is advising and coordinating. It is still mine. I have to make the decisions.

Mr. MCCORMACK. Did not General Phillips have some kind of an advisory committee?

General MAUDE. Not to my knowledge, sir.

Mr. BALWAN. At any rate, you have no assistant now to evaluate—just from the point of view of extra help—the jobs in the 3 laboratories so you have to know more about each of the 3 jobs in the laboratories, or directorates.

General MAUDE. That is where I rely on this buildup that I have laid down in the Plans and Programing Division.

Mr. BALWAN. That, we understand, is headed up by Colonel Adams, who is a military man, not necessarily a research and development man. As I understand it, he is a rated man.

General MAUDE. He is rated, but he has been to the Research and Development Management School of the University of Chicago, and is a graduate of that school.

Mr. BALWAN. How long a course is that?

General MAUDE. One year.

Mr. BALWAN. Had he had other experience in research and development before taking that course?

General MAUDE. I cannot answer.

Mr. BALWAN. What was his last assignment previous to that course?

General MAUDE. That I do not know.

Mr. BALWAN. What I want to bring out to the members of the committee is that we had a technical director who was a civilian who had been there since about 1946—but not under that title all along—who provided some continuity, and civilians do provide more continuity than military people. That continuity was provided by the technical director. How many commanding officers have we had at Cambridge recently or since 1946?

General MAUDE. It was not the Cambridge Research Center then.

Mr. BALWAN. At the Cambridge field station, the Cambridge Laboratory and the Cambridge Research Center.

General MAUDE. I can read them.

Mr. BALWAN. Can you give us the number?

General MAUDE. In some cases it would be the same individual. The name of the organization would change and there was an order put out by the commander.

Mr. BALWAN. If we could just have the number of the different individuals.

General MAUDE. I have six here.

Mr. BALWAN. You had six commanding officers since 1946. I have heard other figures.

General MAUDE. No doubt there would be some in between. Suppose that I was designated commander of the Research Center and I did not arrive until a month later, there would be an acting commander designated.

Mr. BALWAN. It would have been without leadership of some kind for a small interim?

General MAUDE. Not without leadership because someone is always going to assume command. There would be a leader. But there would not have been a designated commander of the station by higher authority.

Mr. BALWAN. There was a minimum of 6 different individuals who served as commanders at the station, and there might be as high as 8 or 9 if we counted the acting commanders?

General MAUDE. Acting in between; that is correct.

Mr. BALWAN. The Air Force policy is to rotate officers for good reasons they have?

General MAUDE. Yes.

Mr. BALWAN. So, to some extent we limit our effectiveness at an operation by the rotation policy of the Air Force. We try to overcome

that by having a civilian director, or having civilian personnel throughout our institutions in the Air Force. In this case, we have no direction except a steering committee and the Plans and Operations Office, and Plans and Operations has a Colonel Adams, who is subject to rotation also.

General MAUDE. Yes.

Mr. BALWAN. We do have a Mr. Jones down there under him, but he has greatly reduced responsibility, at least on the organization chart, from that exercised by the man holding the position of technical director.

General MAUDE. Yes.

Mr. MCCORMACK. How long do you think a commanding officer at Cambridge should serve before being rotated? I assume now that he is doing a good job.

General MAUDE. I would say a minimum of 2 years, and 3 years should be the order of tenure of office.

Mr. MCCORMACK. Do you think that men in offices like yours should be kept in related activities?

General MAUDE. I do not understand exactly what you mean.

Mr. MCCORMACK. Do you think that a man should go from an activity like the one you are now in to an entirely different branch of the service and be put in command?

General MAUDE. From research and development to something else, and vice versa?

Mr. MCCORMACK. Yes.

General MAUDE. Not too often, but I think it is a good thing over a period of service to be totated in different operations. I do not think that an officer should stay in research and development 15 or 20 years. It would be a very exceptional case, in my judgment, that such would be desirable. I think that he should have some operational experience; supply or material experience, possibly. By operational experience, I mean such experience as the Strategic Air Command or the Tactical Air Command, and that sort of experience, in order that he could better do his research and development job.

Mr. MCCORMACK. When you arrived at Cambridge, how long did it take you approximately to get the picture of the general assignment?

General MAUDE. Six to nine months, I would say, at the minimum.

Mr. MCCORMACK. Then you would serve a little over a year and then a new man would come in?

General MAUDE. I said 2 years' minimum; 3 would be much better.

Mr. MCCORMACK. We know it is considerably less, or has been.

General MAUDE. If this pattern kept up.

Mr. MCCORMACK. Then, General, take a 3-year proposition. I am now just using you as an individual as a means of trying to get certain information. It will take you from 6 to 9 months to get the snap of the situation. Then you will serve say for 3 years and another man will come in and it will take him 6 to 9 months to get the snap of the situation.

General MAUDE. For my job, if that is what you are talking about?

Mr. MCCORMACK. Yes.

General MAUDE. It would take a shorter time for somebody lower down in the scale.

Mr. MCCORMACK. I can understand that. What do you think of the overall benefits of such rapid rotation?

General MAUDE. Getting a better rounded picture of the Air Force's overall operations would be the biggest benefit, I think; also not getting into a rut, staying in the same place too long. There is a time phasing in this, sir. I do not know if there is a specific answer, but if you stay too long at one place you begin to perhaps not have the push and it all becomes routine and you might stagnate. On the other hand, you can rotate too often then you will not be familiar with anything.

Mr. MCCORMACK. What opportunities are there under those circumstances for developing specialists among the officers?

General MAUDE. I think that an officer should be rotated in research and development. He should stay in the same job for a period of time, and that could be longer than 3 years, but he should not necessarily stay at the same station for 3 years. Possibly he should move from Cambridge to Wright Field. Now, the time of getting out of research and development would vary with the individual, but I believe that it should be 7 or 8 years, something like that.

Mr. MCCORMACK. Have you ever given consideration to the advisability of creating a research and development bureau in the Air Force like the Army Engineers and the Quartermaster Corps, or the Ordnance Division in the Army?

General MAUDE. I presume that has been considered. I have not been in on that.

Mr. MCCORMACK. I am just asking your personal opinion. That would not mean you would be confined to any one thing. You would have this overall experience where they would be in the related field of activity.

General MAUDE. Personally, I would rather the Air Force remained as an Air Force without the various corps in it.

Mr. MCCORMACK. How much military do you have at Cambridge?

General MAUDE. Two thousand military and two thousand civilians. That includes the whole center, wing and all.

Mr. MCCORMACK. That is not Cambridge alone?

General MAUDE. That is the Cambridge Research Center with its activities at Hanscom Field.

Mr. BALWAN. Could we have that officially transmitted, the strength and the divisions? Could you provide the subcommittee with that?

General MAUDE. Do you mean the exact figures?

Mr. BALWAN. Not at this time.

General MAUDE. I can give it to you right now if you want it.

Mr. RIEHLMAN. Before you leave will you do that?

Mr. MCCORMACK. Are the military paid out of the budget allocated to research and development?

General MAUDE. No. The pay of all military personnel is out of one budget. It is not separated in the pay of military personnel, research and development, and pay of military personnel, something else.

Mr. MCCORMACK. How many scientists do you have under your command?

General MAUDE. Well, the GS–12's and up would show that. I have a breakdown of that. We have the strength at the beginning of June, 164.

Mr. MCCORMACK. That is in your whole command?

General MAUDE. The whole command.

Mr. MCCORMACK. How many officers do you have in your command?

General MAUDE. Right now the strength of the Cambridge Research Center, officers, authorized, 409, assigned, 330. We are under strength in that field.

Airmen overall, 1,459 authorized; assigned 1,640. We are over strength in airmen.

Total civilians authorized, 2,037; assigned, 2,025. The total strength authorized, 3,905; assigned, 3,995.

Mr. IKARD. Do you know where the previous commanders of this have gone when they left; do you know what bases they have gone to? Generally, have they remained in this field, or have they gone into other fields? What kind of command do they have? I know that some of them have retired.

General MAUDE. Some have retired; yes. Colonel Mitchell has retired. Lieutenant Colonel Tetley, who is listed here as a commander at one of the periods is at this time an instructor at the Military Academy. Colonel Davison, I do not know. Colonel Duffy, I do not know. There is a Major Fletcher in the Air Weather Service at the moment. Whether it is the same Fletcher here, I do not know.

Mr. IKARD. I just wanted to know, as Mr. McCormack was saying, whether these men are generally in research and development, or in other phases of the Air Force operations. I realize that you possibly cannot answer the question.

General MAUDE. I do not know.

Mr. RIEHLMAN. I have just one or two questions.

In looking over the chart here where you have atomic warfare, electronics research, and geophysics, you have stated to the committee that it is about humanly impossible to get a man who is proficient in those three operations.

General MAUDE. Yes.

Mr. RIEHLMAN. Have you ever given any thought to that being poorly organized then and that you might better specialize in one field and do a good job? Have you ever made any recommendation that these 3 should not be combined into 1 research center if you do not think you can get a scientist who can head up the group and do the job as he should?

General MAUDE. No, sir; I have never done that. I have never given any thought to it.

Mr. RIEHLMAN. What is the title and what is the background of the gentleman who is heading up the electronics research directorate?

General MAUDE. The present one?

Mr. RIEHLMAN. Yes.

General MAUDE. He is a physicist, I believe. He is only acting. I had him under my control, and I thought he would be able to do a good job in the interim until we could find a new director in electronics. He was working with our people in the field of human engineering. I believe that is the title that is applied to it.

Mr. RIEHLMAN. I am not trying to be critical. I was just trying to evaluate the change that was made in view of the fact you put a man in charge of electronics with that background and you removed a man up here who is a specialist in electronics, understood the whole

field of activity. What I would like to know is why he would not be in a far better position to evaluate the three activities than this man with the background you have described.

General MAUDE. He was only put in charge of electronics on account of the previous one resigning. The Scientific Advisory Board is now assisting us to get a man for that job.

Mr. RIEHLMAN. Have you had any opportunity to evaluate this gentleman's background?

General MAUDE. Since the gentleman has been there I would say that the morale of all of the electronics directorate has improved considerably.

Mr. RIEHLMAN. I am just trying to see if I can bear out your philosophy in removing a man up here who had a great background in electronics. Although you say you are trying to find a man for this field and probably will find one, it is a little difficult for me to understand the reason for removing a civilian who has had an apparently good background in that field. I restate again, as I did before, he certainly would have had some broad knowledge of these other activities, having worked in the field so long.

General MAUDE. The gentleman that was removed from here became this one here [indicating].

Mr. RIEHLMAN. I understand that. He went down in charge here, but his whole background was electronics.

General MAUDE. That is right.

Mr. BALWAN. Did we lose a pretty valuable scientist in electronics, not as an administrator?

General MAUDE. I think we lost a very excellent electronics engineer. I would not say scientist.

Mr. BALWAN. Did he have an electronics specialist under him? When Marchetti was technical director, who was the director of electronics?

General MAUDE. Dr. Schneider.

Mr. BALWAN. Was he a pretty good electronics man?

General MAUDE. In my opinion, Dr. Schneider was a good electronics man, but not a good administrator of that directorate.

Mr. BALWAN. Why did not Dr. Schneider take over the position of Mr. Marchetti as head of the electronics directorate when Marchetti left?

General MAUDE. Dr. Schneider resigned at practically the same time that Mr. Marchetti resigned.

Mr. BALWAN. You lost two scientists?

General MAUDE. Yes.

Mr. BALWAN. It is rather unfortunate to lose scientists like that from the military laboratories?

General MAUDE. Yes; it is unfortunate to lose scientists.

Mr. BALWAN. Did you go to the human factors research laboratory to get a man to be acting director?

General MAUDE. I did, sir, because I could not find another temporary man within electronics that was in my opinion suitable to be the acting director.

Mr. BALWAN. You had no one in the electronics directorate who could be a suitable man to run the electronics directorate?

General MAUDE. In my opinion, that is correct.

Mr. RIEHLMAN. At that point, this really points up the seriousness of losing men if they have good qualifications and good backgrounds in those fields by virtue of a change in the administrative structure in the center. Again, I just want to be most fair, General, in my observations, but to me that is not alone costly but it may be very treacherous to our research programs in these different areas, when you have that feeling going on amongst the scientists, the scientist groups, throughout the Nation. I am only saying this as a friend of the military program and of those in the service. Certainly that does not just end with the scientist who left the service. They must have friends and others in the service, and if there are misunderstandings and reasons for them to resign, I just worry about the effects of it. I say that to you very seriously and honestly.

General MAUDE. This directorate was during the regime of Dr. Schneider, the directorate being the electronics directorate. It became very much—I will not say disorganized—but there were many people who came to me during the period of July and August until the time that Mr. Marchetti's job was abolished and complained about the way the electronics directorate was being managed, the scientists and the others, the laboratory chiefs, and other people.

Mr. RIEHLMAN. I want to ask this question, and I want it to be perfectly understood as being fair: Was this change made and the position abolished for the purpose of getting rid of Mr. Marchetti?

General MAUDE. No, sir, not when the position was abolished. I was not getting rid of him. I did not think of getting rid of him until other events happened.

Mr. RIEHLMAN. You said that you had many complaints from a division.

General MAUDE. Along in the fall I did. The complaints were along this line—that Dr. Schneider would not do anything without running to Mr. Marchetti, and many of these people said, "We think Mr. Marchetti is nothing," as I said before, "but another director of electronics." The way he was managing the program there were many complaints about it along that line.

Mr. RIEHLMAN. Would it not be quite natural for the directorate head in charge of electronics to go to Mr. Marchetti, who is the director up above? That is what you would want to happen, free access back and forth, so there should not be any complaint from someone down here on the lower level because of the directorate head going to the deputy in charge of these three activities with information and asking for help and advice. As you say, he apparently was a good electronics man. That would be normal, would it not?

General MAUDE. That would be normal.

Mr. MCCORMACK. You have admitted that it is hard to get a man who is a specialist in electronics, geophysics, and atomic warfare, but one who might be a specialist in one might have a pretty good knowledge of the other two. That is what Marchetti had, is that not so?

General MAUDE. He had a good knowledge of one.

Mr. MCCORMACK. If he is a good man in electronics and as commanding officer you have some important question in connection with the laboratory related to electronics, would you not talk to the head of the electronics division?

General MAUDE. Yes.

Mr. McCormack. And in the same way, if you were consulting with myself—assuming that I was technical deputy and was qualified in atomic warfare—and a man in that position should have administrative ability with a knowledge of other activities—and if you had occasion to discuss atomic warfare with me as your technical deputy and the one to whom you looked for advice, you naturally would call a conference involving any kind of an important matter and call in the head of the division of atomic warfare. You would have a conference or a huddle. In practical operations you reach down anyway and talk any kind of an important matter over with the heads of the various divisions and with the technical deputy, whoever he might be——

General Maude. You reach down.

Mr. McCormack. You reach down anyway.

General Maude. I would think so.

Mr. Balwan. In this case you went to the Human Factors Laboratory to get a director because you could not find a man from within a division of the directorate.

General Maude. I called all of the key people in the directorate together when we lost Mr. Marchetti to ask them if they would give me a recommendation as to who would be the Acting Director; who they considered would be a good candidate for the Acting Director until we were able to find a new Director.

Mr. Balwan. The staff, in talking to various people at Cambridge, and in talking with General Maude himself, discussed this problem of getting an outside man as Acting Director, and the reason we were given is that the divisions in the electronics directorate were so split that the components division would have resented it bitterly if the system division man had headed it up. The systems people were so upset about the components division that they would have resented having a components man there. We had a kind of pathological condition there that could not be corrected by getting men from within to head it up. Am I wrong in that impression?

General Maude. That is right. You are right.

Mr. Balwan. In view of the fact we have a kind of pathological condition there which, among scientists, is not kept a secret—I mean they have their organizations and talk to people in industry—might it not be difficult for the Air Force to get good scientists to come into the situation? This becomes a kind of hot potato that people do not want to touch.

General Maude. I do not think it has, but it might. Since Dr. Frick, who is now the Acting Director, came this situation has improved.

Mr. Balwan. I am glad to hear that. The point is that it would be very unfortunate if the Air Force were operating a research center where conditions got so bad we could not get top people to come there.

General Maude. That would be very true, but I do not think that is true now.

Mr. Balwan. I have one more question. When you were considering abolishing the position of Technical Director, did you consult with your own organization? Did you consult Colonel Jack?

General Maude. I did.

Mr. Balwan. And Dr. Landsberg?

General MAUDE. I did.

Mr. BALWAN. Did they recommend that the position be abolished?

General MAUDE. I would not say they recommended it, but they did not object to it.

Mr. MCCORMACK. You would not expect them to object to you?

General MAUDE. I went to Dr. Landsberg in his office and asked him if he thought he was getting any help out of this office and would the operations be handicapped if there was no such office, and things of that nature. I was not asking him to concur with my action one way or another. I was looking very conscientiously for advice in the matter, and I got it.

Mr. MCCORMACK. You said you were not asking him to concur in your action. I think you should explain that for the record because one might think you had your mind made up before you went to him.

General MAUDE. I see your point.

Mr. BALWAN. Would you like to clear up the record so that it might not be misunderstood?

General MAUDE. I am trying to think how to say it.

Mr. MCCORMACK. We are here constructively.

Mr. IKARD. What you are saying is that you were disturbed and were seeking advice from your people?

General MAUDE. That is right.

Mr. IKARD. And after you acquired that advice you acted on your own initiative?

General MAUDE. I did it entirely on my own initiative.

Mr. IKARD. But after you had gotten this advice?

General MAUDE. That is right.

Mr. IKARD. I think that makes it very clear.

Mr. MCCORMACK. We have a summary from counsel and the staff, and I happen to note that General Phillips instituted a rule requiring Air Force officers to wear civilian clothes at the center unless some higher authority required their wearing a uniform. Are you following that rule?

General MAUDE. That rule is still in effect.

Mr. MCCORMACK. Are there any suggestions you might make as to how you think improvements might be brought about? I am not asking about complaints about your service, but complaints as to laws or regulations or any suggestions affirmatively where you think the work of research and development might be improved. We have only one common interest in mind, the national interest of our country, realizing the world of today with the sinister forces who are employing every means they can to develop offensive and defensive weapons.

General MAUDE. I do not know if it is appropriate or not, Mr. McCormack, but if we could pay our civilian scientists more we could probably do much better.

Mr. MCCORMACK. We have had evidence to that effect from the Assistant Secretary of Defense and others, both in the military and civilian on the Washington level. Are there any difficulties in getting qualified people up there because of the salary situation?

General MAUDE. Yes, sir.

Mr. MCCORMACK. Will you explain that?

General MAUDE. The main trouble is we cannot compete, particularly with industry, in getting people. We can get youngsters from

schools, but very shortly they become proficient,more experienced, and have greater offers from industry. I do not think our salaries are lower than in universities except at the upper level of the university professor or head of the department, but we lose many people to industry.

Mr. McCormack. Are the rules and regulations in relation to science geared to the organic law in relation to the conduct of one of the branches of the armed services? Do you understand what I mean?

General Maude. No, sir.

Mr. McCormack. Usually your rules and regulations in the Army are related to your infantry, and so forth. Are your regulations relating to research and development based upon that theory of law?

General Maude. I think generally speaking I would say "yes," they are more or less made for the Air Force as a whole rather than specific ones for research and development.

Mr. McCormack. Do you think in the case of research and development there needs to be some change to fit the situation that applies there?

General Maude. If we could make it a little easier for the civilian scientists not to be hampered with too many regulations; I know that bothers them.

Mr. McCormack. I think that is hitting a pretty important point. Will you amplify that?

General Maude. They resent, I believe, or a certain portion of them resent, what people call the military redtape and regulations for accounting for supplies. The supply accountability is, generally speaking, the same in the research and development as in any part of the Air Force. In the past few years we have improved that situation. If a scientist needs a resistor or a tool he can now get it by just signing; he does not have to put in a requisition and have it approved down the line. That has helped with the scientists. That is the nature of the complaints, the little things that irk scientists.

Mr. McCormack. Your whole life has been one of discipline and obedience. That is, most of us have been in the service and know that that is true.

General Maude. Yes, sir; since I graduated from the Military Academy in 1926.

Mr. McCormack. And you are dealing with people whose lives are as far removed from the military as can be.

General Maude. Yes, sir.

Mr. McCormack. They have to work together. It is vitally important.

General Maude. Very important.

Mr. McCormack. The question is, there is no such thing as perfection, but how can we approximate it?

General Maude. Things to improve the situation are being done gradually.

Mr. McCormack. I appreciate that. It is something new and I realize we cannot be perfect, but we are trying to be as nearly perfect as we can and make as many improvements as we can because 1 discovery by 1 of these brains with others in the various fields perfecting it, might mean the difference between victory and defeat.

Even a discovery for the avoidance of trench feet; we know what has been accomplished in that direction. Am I right?

General MAUDE. Yes, sir.

Mr. MCCORMACK. And the drinking of water in various countries. In Korea we know we had almost as many casualties from illnesses as from being wounded. So it is not only the production of weapons, but work in thousands of other directions. Is that right?

General MAUDE. That is right, yes, sir.

Mr. MCCORMACK. How do you get along with the various universities like M. I. T.?

General MAUDE. Very well.

Mr. MCCORMACK. Of course Boston is an ideal site for laboratory work, is it not? It could not be better.

General MAUDE. No, sir; it could not be.

Mr. IKARD. Do not leave Texas out. It is good too.

Mr. RIEHLMAN. Are there any other questions of the general?

Well, General, I think that is all we will ask of you this afternoon. We want to express our appreciation for your coming down and giving us this information.

Mr. IKARD. I think the general's testimony was very informative.

Mr. RIEHLMAN. Yes. Do you want to leave these charts with us?

General MAUDE. Yes.

(The charts referred to are herewith inserted.)

TESTIMONY OF JOHN WILLIAM MARCHETTI, FORMER TECHNICAL DIRECTOR, CAMBRIDGE AIR FORCE RESEARCH CENTER

Mr. RIEHLMAN. Mr. Marchetti, our staff has had some conferences with you in respect to the position you previously held at the Cambridge Research Center. We are vitally interested in this program of research and development and we have known something of your background and experience in that field and are very anxious to have some testimony from you in respect to those activities up there.

Mr. MARCHETTI. I have been very pleased to talk to Mr. Balwan and have given him a fair amount of information already. I frankly do not know where to start.

Mr. BALWAN. May I ask some questions?

Mr. RIEHLMAN. Yes.

Mr. BALWAN. Do you want to swear the witness in?

Mr. RIEHLMAN. We have sworn the other witnesses, have we not?

Mr. BALWAN. Yes, we did yesterday.

Mr. RIEHLMAN. I think it would be well if you will raise your right hand and you swear the testimony you will give to this committee will be the truth, the whole truth, and nothing but the truth?

Mr. MARCHETTI. I do.

Mr. BALWAN. What is your full name?

Mr. MARCHETTI. John William Marchetti, M-a-r-c-h-e-t-t-i.

Mr. BALWAN. What is your present position?

Mr. MARCHETTI. At present I am not working. I resigned from the Cambridge Research Center as of May 1.

Mr. BALWAN. Were you technical director as of May 1?

Mr. MARCHETTI. I was not. Through administrative action, at the time of my resignation I was director of electronics.

Mr. BALWAN. Director of electronics was you most recent position?

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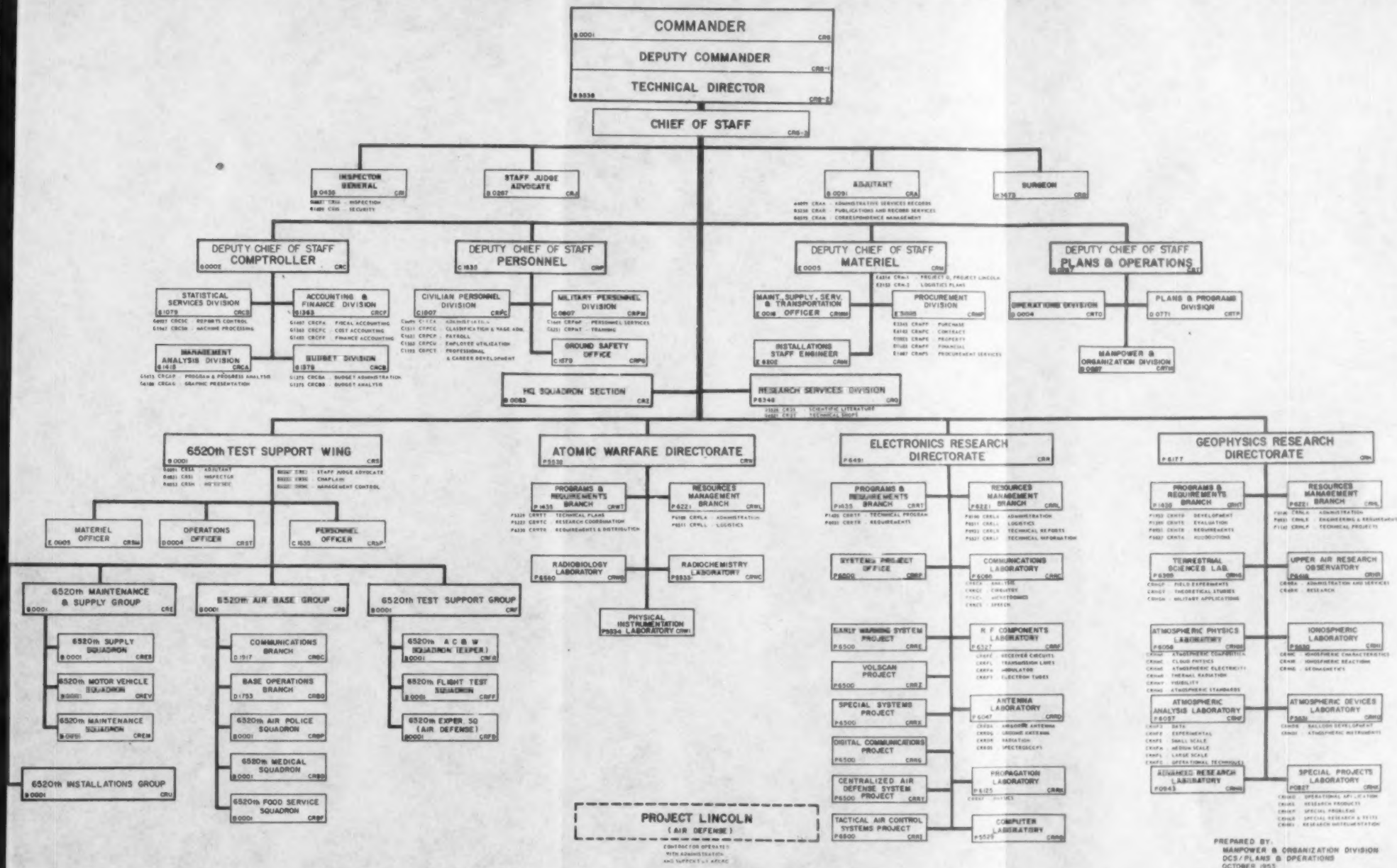

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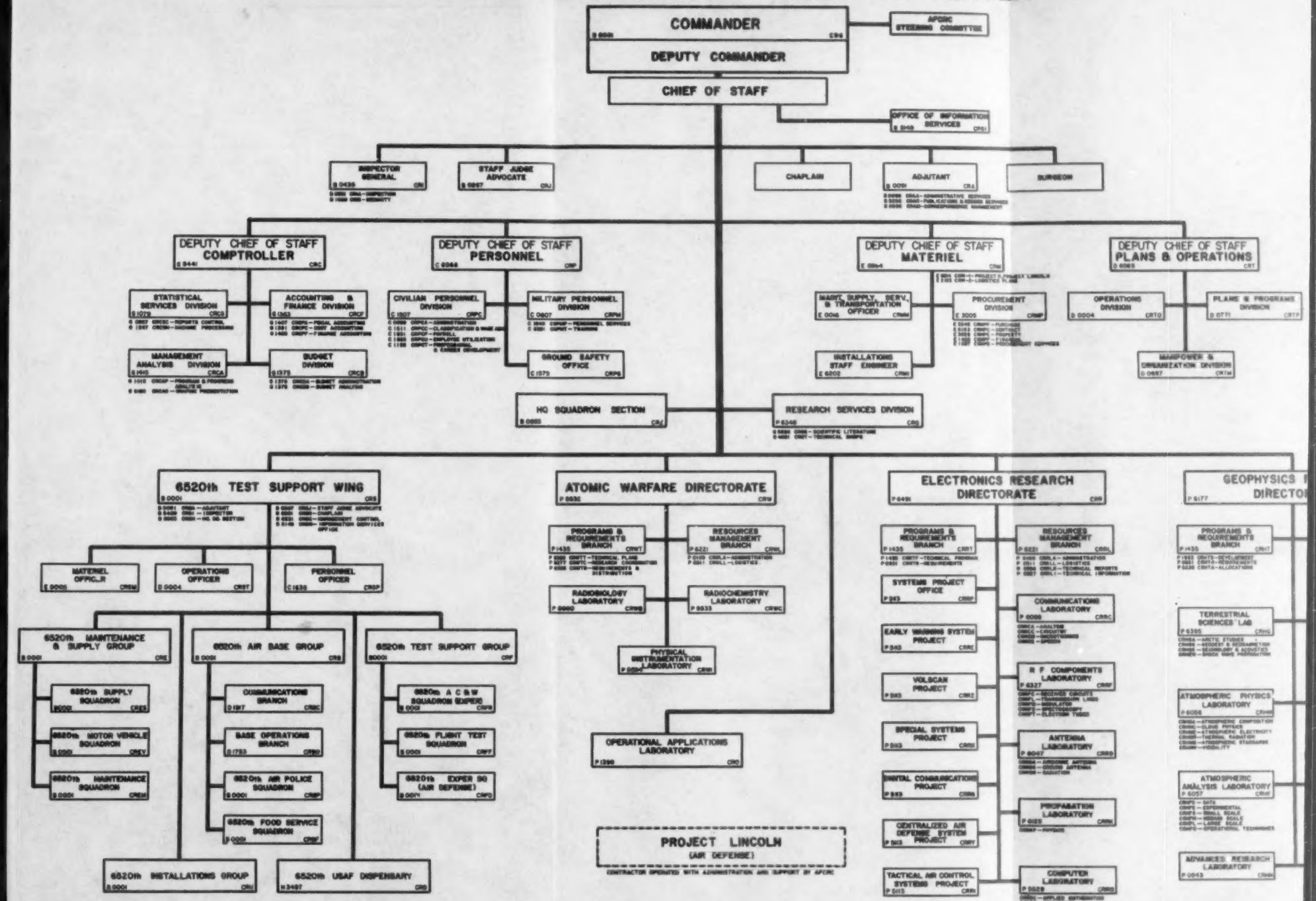

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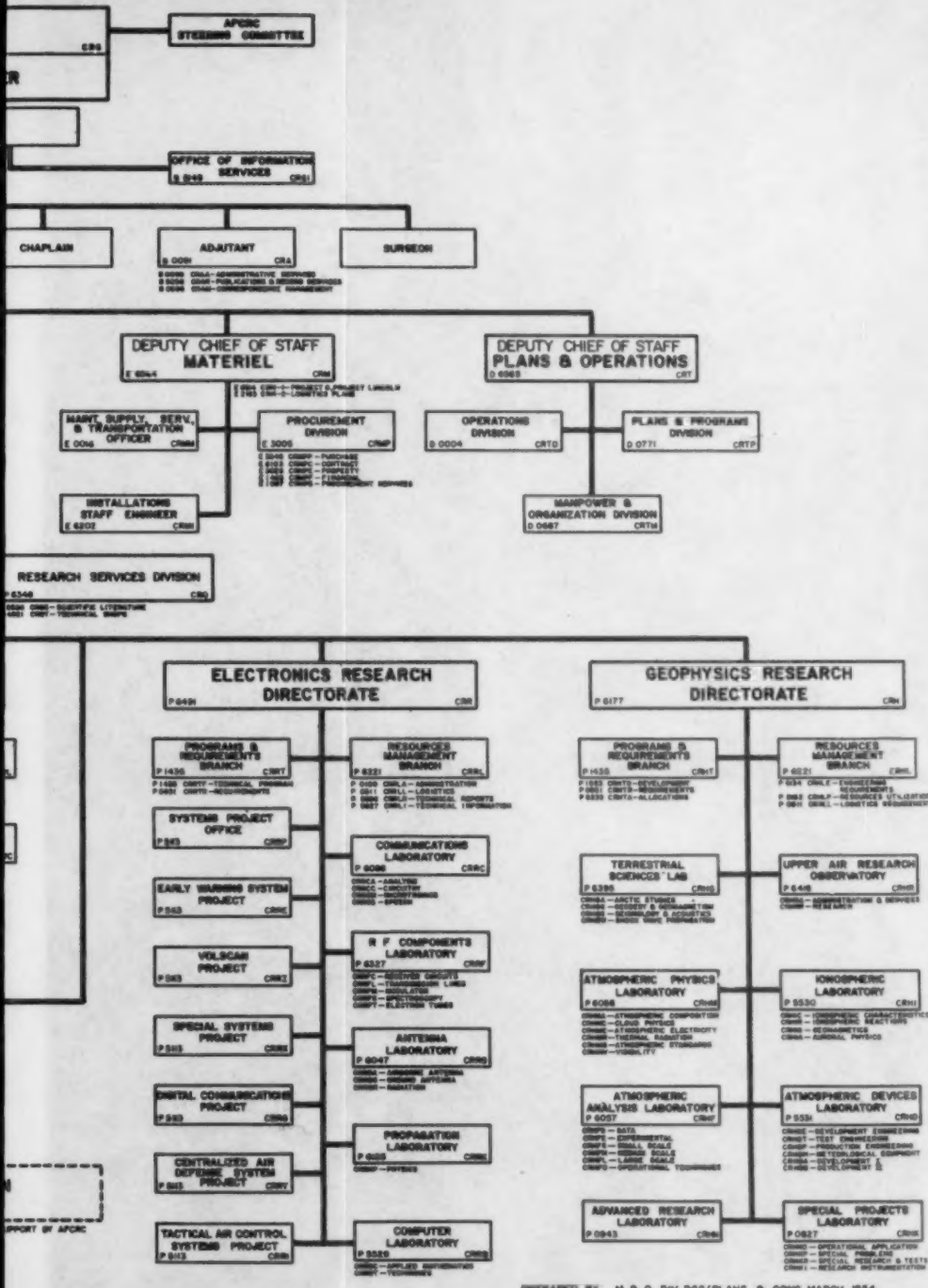

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Mr. MARCHETTI. Yes.

Mr. BALWAN. Can you describe to the committee what your experience has been in this scientific work?

Mr. MARCHETTI. I have been in Government technical work for approximately 16 years. I started out in the original radar research work done at Sandy Hook previous to the last war.

Mr. BALWAN. Was that with the Government?

Mr. MARCHETTI. It was.

Mr. BALWAN. In what branch of the Government?

Mr. MARCHETTI. In the Signal Corps. At that time all the electronic work for the Government was done by the Signal Corps of the Army and of the Air Force when the Air Force was the Air Corps.

I was with that early radar research group and did design work on early radars, continuing through the war.

Mr. BALWAN. That is work connected with Fort Monmouth?

Mr. MARCHETTI. Yes. Sandy Hook was a subsidiary of Fort Monmouth.

Mr. BALWAN. Can you tell us what schooling you have had in this field, your training?

Mr. MARCHETTI. I came into the organization as a fairly young engineer.

Mr. BALWAN. What was your technical training?

Mr. MARCHETTI. My technical training was at Columbia and as an electrical engineer.

Mr. BALWAN. What year were you graduated?

Mr. MARCHETTI. 1931.

Mr. BALWAN. Did you have any other university work?

Mr. MARCHETTI. One year of graduate work leading to a master's degree.

Mr. BALWAN. Where?

Mr. MARCHETTI. At Columbia also.

Mr. BALWAN. What degree did you receive there?

Mr. MARCHETTI. A bachelor of science degree in engineering and a master's degree in E. E.

Mr. BALWAN. What does the "E. E." stand for?

Mr. MARCHETTI. Electrical engineering.

Mr. BALWAN. What other formal training did you have?

Mr. MARCHETTI. That is all. Then I went with the radar group at Fort Monmouth and helped to design some of our war radars. I actually designed about three of them.

Mr. BALWAN. Could you give us a brief description of the kind of radars you designed?

Mr. MARSHETTI. I designed partially the SCR 268 and made the complete design on the SCR 648, and some of the design on the mortar locator used in Korea in the last war.

Mr. BALWAN. What part did you play in it?

Mr. MARCHETTI. I was a radar designer. During the war I continued to work in development. At the end of the war I disassociated myself from the Signal Corps and joined the Air Force at the same time the Air Force broke away from the Signal Corps for their electronics work, mainly due to the fact I had been spending most of my time on long-range detection radar and the only work I had done for the Army was the mortar locator.

I went to Cambridge about the time the OSRD was closed down and set up the Cambridge Field Station.

Mr. BALWAN. Were you an officer then?

Mr. MARCHETTI. I was a major.

Mr. BALWAN. A major in the Air Force?

Mr. MARCHETTI. A major in the Air Force. At the time OSRD closed down, we hired 200 technical people from the two institutions closed in Boston, the Radiation Laboratory at MIT and the Radio Research Laboratory at Harvard.

Mr. BALWAN. You, as an Air Force officer, were assigned to set up a laboratory at Cambridge?

Mr. MARCHETTI. That is correct.

Mr. BALWAN. Did they have any organization at Cambridge?

Mr. MARCHETTI. None whatever.

Mr. BALWAN. You were sent up to set it up?

Mr. MARCHETTI. That is correct. That was being done by practically all of the organizations that were looking for technical people at that time, General Electric and all of them had people up there to pick up talented people when OSRD was closed down. I hired about 200 people which formed the nucleus of the Cambridge Field Station.

Mr. BALWAN. That was the first name?

Mr. MARCHETTI. That was the first name.

Mr. BALWAN. You were the commanding officer?

Mr. MARCHETTI. I was the commanding officer for a period of about a year, during which time I was in uniform. I wore two hats, I was technically in charge of it as well as the commanding officer.

When I left the service——

Mr. BALDWIN. What year?

Mr. MARCHETTI. I think it was 1946 or 1947. I am not too sure of this but it was about the order of 8 months after V–J Day.

I returned to my old civilian position, which was with the Air Force, as a civil servant, and assumed the duties of Technical Director of this small group of people that I had initiated at Cambridge. That was approximately 9 to 10 years ago now, and during that entire time I have been the senior civilian at Cambridge. This group finally grew to a group of some 700 technical people in the electronics field. It was originally electronics and grew from being a field station to being just a straight research laboratory, and some 3 or 4 years ago additional functions were brought there, two in particular, one in geophysics and one in nuclear physics, call the Atomic Warfare Division. It was actually a small research group in the nuclear field.

I moved from the position of Director of Electronics, this single group, to overall senior civilian, and became Technical Director of the Cambridge Research Center.

Mr. BALWAN. What civil-service grade did you hold for that?

Mr. MARCHETTI. It was Public Law 313.

Mr. BALWAN. A Public Law 313 position?

Mr. MARCHETTI. Public Law 313.

Mr. BALWAN. At what salary?

Mr. MARCHETTI. $13,500.

Mr. BALWAN. $13,500?

Mr. MARCHETTI. $13,500. I held this position as senior civilian over the three essential groups— and each one of them had its own

separate director—until approximately December. I am sorry—February of this year, at which time a series of events at Cambridge involving difficulties with General Maude resulted in my moving down to Director of Electronics and to my final resignation. My resignation was effective May 1.

But I have been with the Cambridge Research Center as its senior civilian from its very inception until my resignation.

Mr. BALWAN. I have no questions on this part, unless somebody has questions.

Mr. RIEHLMAN. Any questions on this part of his testimony?

Mr. MCCORMACK. During that period did you have any difficulties with the Directors of Atomic Warfare and Geophysics?

Mr. MARCHETTI. No, not at all. Each one of these directors operated with a fair amount of autonomy, because they were specialists in their field.

You must understand that my field is not geophysics, nor is my field atomic warfare. My field was as an electronics specialist. All I exercised over these other two functions, which were essentially foreign to me, was administrative control.

This is perfectly normal in an organization where you have so many diverse technical functions to do. No one man can be competent in all these fields. The senior man, if his training has been broad enough, is set up to oversee it. For instance, an electronics man was set up in this particular instance to oversee the geophysics work and the atomic warfare work. It might just as well have been a geophysicist supervising electronics work on the overall, providing his basic training had been broad enough to cover that field, although his real work as a scientist had been done in a specialized field; not geophysics or atomic warfare.

Mr. MCCORMACK. Was your broad work, in your opinion, sufficient to have you feel—as an electronics specialist scientist—you could occupy the position of technical deputy or Technical Director to the commanding officer in the three spheres of activity?

Mr. MARCHETTI. I had been set up in that job by General Phillips when he came in. I assume the reason he put me in is that he felt I had the qualifications for the job, and also I had been recommended by the scientists in that area.

Mr. MCCORMACK. You have some familiarity with atomic warfare?

Mr. MARCHETTI. Oh, yes.

Mr. MCCORMACK. Will you give for the record what your familiarity with that is?

Mr. MARCHETTI. The atomic warfare work that we did involved the separation of some isotopes in cloud samples. A fair amount of this work involves electronics techniques.

Science is a fairly specialized field. It is broken down into specialized fields, but the tools for it are pretty broad. Just as geophysics itself is a study of the atmosphere, yet the basic physical principles are identical in all three fields, particularly if one has the detailed workers who have spent most of their time in that particular field.

That is, as Technical Director and you must understand I did not supervise every job in its intimate detail. This would be impossible. We had some 1,000 people working there.

Mr. BALWAN. Was it expected of you to guide the program?

Mr. MARCHETTI. Definitely.

Mr. BALWAN. In the directorates?

Mr. MARCHETTI. Yes, it was.

Mr. BALWAN. You felt qualified to guide the program in the three directorates?

Mr. MARCHETTI. Yes. I did guide them for a period of about 3½ to 4 years.

Mr. BALWAN. Did you also have to advise the commanding officer on the work you were doing in the directorates?

Mr. MARCHETTI. Oh, yes.

Mr. IKARD. Your job is primarily an administrative job as the technical director and a coordinatory; is that correct?

Mr. MARCHETTI. That is correct; but a little more than this.

Mr. IKARD. Along with also being in a sense a liaison man?

Mr. MARCHETTI. Let us give a concrete example in both fields.

Mr. IKARD. That is fine.

Mr. MARCHETTI. In the geophysics field we had several laboratories set up, let us say. To mention them: One in cloud physics, one in upper air research.

A problem came up. Should we or did we have the competence to do met instrument design, meteorological instrument design? The decision as to whether we would take on this job was mine, and not the Director of Geophysics, because to a large extent this meant a commitment of manpower dedicated to turning out certain black boxes, as we call them, instruments, that would do a particular job; and it meant we had to shelve a certain amount of our other work. This decision, of course, was made in consultation and talking it over with Dr. Landsburgh, who was Director of Geophysics. A, we had to determine whether we had the manpower and experience and the intrinsic ability to do the job; and whether we should dedicate that portion of our budget—dilute other work we were doing—to the extent of taking on this additional job of doing met instruments. We did take on that job in spite of the fact that some of the people frowned upon it. But the decision for taking on that job was mine.

In the electronics field a decision as to whether we would go from a purely basic research group and take on a job of air defense which was required at the time had to also be decided. Who was to work on it? How much money was to be spent on it? And how big a bite of that job were we to take was also my decision.

As a matter of fact, again here in the electronics field this was a job that the Director himself was not sure we should take on.

Mr. MCCORMACK. It was all in consultation?

Mr. MARCHETTI. With the directors. We always talked this over. We had to see what the factors were; the factors being: (*a*) Would we have men with competence or could we get men with competence to do this job? (*b*) Did we have facilities or would this overemphasize one field as against the other? (*c*) Did we for the future plan to go into pure electronics work or pure geophysics work?

Mr. IKARD. The final responsibility for each of those decisions was yours?

Mr. MARCHETTI. That is correct.

Mr. BALWAN. Could the commanding officer have exercised the same kind of judgment?

Mr. MARCHETTI. It all depended on the commanding officer. General Phillips, the previous commanding officer, one that I considered good, would have taken my advice and followed it. There have been some commanding officers at Cambridge who would not have.

Mr. LIPSCOMB. Did you have to go to the commanding officer with your decision, to let him know?

Mr. MARCHETTI. Yes.

Mr. IKARD. Even though you made that decision, was it made in his name, or was it made in your name?

Mr. MARCHETTI. It was made in my name.

Mr. IKARD. Suppose there was a disagreement between you and the commanding officer. From an organization standpoint what would happen?

Mr. MARCHETTI. That is what happened.

Mr. IKARD. I know it is.

Mr. MARCHETTI. Well, generally speaking, if an overriding of a decision arrived at on purely technical grounds——

Mr. IKARD. That is what we are talking about.

Mr. MARCHETTI. Let us say either one of these points I brought up it was decided to take course A on the basis of the pure technical side, and the commanding officer decided for some other reason that we would not do this. If it was not too important a decision I would ride along.

Mr. IKARD. Surely.

Mr. MARCHETTI. If it was one that meant the very future of the laboratory I would do my very best to convince him or higher headquarters, because besides the immediate military commander it is a job of convincing the Baltimore folks, who are our headquarters. This, again, was part of my job, to sell them on the validity of doing this, when the validity had been determined entirely on technical grounds. In those cases where I was able to convince them that this should be done the system worked well.

Mr. IKARD. How often in your experience did that situation occur? Not the exact number. Was it a frequent occurrence?

Mr. MARCHETTI. It was a continual occurrence. I do not think that decisions arrived at on the basis of their technical desirability were followed—well, I would like to put it in a slightly different way.

In Cambridge we have had in 9 years approximately 12 military commanders. There has been quite a high turnover, probably due to the fact that we were a growing organization. We started with a major as a commanding officer, and we wound up with two 2-star generals as commanding officers, as it developed in importance.

In that period I would say that we had about 10 percent of the time when conditions were excellent. That is, the commanding officer was such a man that given a course to follow on the basis of technical grounds he would follow it because: (*a*) He either understood it, or (*b*) he trusted me.

In about equally 10 percent of the time it was absolutely horrible. We got decisions that were stupid, just plain stupid; and some that were intolerable, which was the result of my leaving.

The rest of the time it was just touch and go. I would call this 80 percent of the time. You would get a minor decision turned against

you but it was tolerable. It was just a continuous fight, but you could exist under it. It was unpleasant, however, if you had some doubts in your own mind as to whether you would take course A or course B, and you were not sure, you were using an educated guess when you should take course B, if somebody had some other reason for wanting to take course A you would go along, because in a research laboratory you must realize there are lots of times when you cannot be absolutely sure.

Mr. IKARD. Surely. That is right. I have one more question.

How many of these 12 people who have been in command of this laboratory, and how much of the time, did you have a trained man? I realize he could not be a scientist.

Mr. MARCHETTI. Some were.

Mr. IKARD. Or could not be a technician. How many of them understood or attempted to understand the scientific approach to these problems?

Mr. MARCHETTI. Two of the twelve. By name; General Phillips, who was quite a capable technical man in his own right, Major General Phillips; and Col. Hugh Mitchell, who in many cases understood but was not as capable a man technically as General Phillips, but understood enough so that he was trusting and took good advice. The rest of them I would categorize as very bad, or at best tolerable.

Mr. IKARD. From a technical standpoint.

Mr. MARCHETTI. From a technical viewpoint. There were some of them who just admitted, "I know nothing about this. Tell me what to do and I will do it."

Mr. IKARD. That is no indictment of the military people.

Mr. MARCHETTI. No; I did not mean it like that.

Mr. IKARD. I know you did not. I wanted the record to be clear.

Mr. MARCHETTI. Surely. Quite often a man came in; he was set up as an administrative position, a military command. He just did not know and said, "What shall we do?"

Mr. IKARD. I do not want to get into each man individually, but as a class do you know what their background was? Was it technical or purely military?

Mr. MARCHETTI. Two of them were technical. General Maude, the recent one with whom I had most of my disagreement, I think is possibly technical. He has as background electronics, and was a communications officer during the war. This is a bit of technical background; not sufficient, in my opinion, to run as complicated a research laboratory as we have at Cambridge from a purely technical point of view.

Mr. IKARD. That is what we are talking about.

Mr. MARCHETTI. He quite probably has the ability to run it administratively. These are two facets that are almost impossible to divorce; that is, the administration of a laboratory and its technical function.

Mr. IKARD. Mr. Chairman, I have another question here, but I do not want to take up too much time of the committee.

Mr. RIEHLMAN. You go aright ahead.

Mr. IKARD. This difficulty that you experienced as the senior civilian and technical director, which you just outlined here, to what degree was that transmitted down to the lower echelons? I mean, what was the feeling, or was there a feeling reflected on account of this condition

among the scientists and engineers who were working down below in lower echelons; the directors of these three branches and the people who were under them?

Mr. MARCHETTI. Generally speaking, at the lower levels there was a fair amount of insulation. I could generalize further by saying——

Mr. IKARD. You understand, I am talking here, as we were, about technical matters. I am talking about, for lack of a better term, your truly scientific people, and not some boy just out of college. I mean your top people.

Mr. MARCHETTI. Well, to those people they were all aware of it.

Mr. IKARD. What was their general reaction to it?

Mr. MARCHETTI. Well, it was pretty bad. Since General Maude arrived at Cambridge all four senior civilians have resigned.

Mr. BALWAN. What senior civilians?

Mr. MARCHETTI. I resigned, when I was originally technical director. Dr. Schneider, the electronics director, resigned, directly involved in the same controversy.

Mr. Metz, who was the senior civilian in atomic warfare, resigned for a very closely allied reason.

And Dr. Landsburgh, the director of geophysics, resigned, although his reason is one that is not as intimately tied up with our controversy; that is, the electronics people's controversy. It is practically of the same cloth.

I think I could tell you that it is of the same cloth when I give you a quote of his. His quote to me, given at his home, was that he was delighted to take this job with the National Weather Service in Washington, which is where he has gone, because it is a job he had always looked up to and felt was appealing; but that if General Phillips with his policies had remained at Cambridge he would find it very difficult to accept this job. This is kind of a left-handed way of telling you the man felt the same way.

Mr. MCCORMACK. What was your relationship with Dr. Landsburgh?

Mr. MARCHETTI. I was his boss.

Mr. MCCORMACK. What was your relationship?

Mr. MARCHETTI. Very excellent, if you mean by this how did we get along.

Mr. MCCORMACK. Yes, how did you get along?

Mr. MARCHETTI. Fine.

Mr. MCCORMACK. Do you think he would say anything adverse about you?

Mr. MARCHETTI. I do not think so; but you should ask him.

Mr. MCCORMACK. Do you know of any reason? Is there any indication in your relationship with him? Was your relationship with him friendly?

Mr. MARCHETTI. Very friendly.

Mr. MCCORMACK. Unfriendly or in between?

Mr. MARCHETTI. No, very friendly

Mr. MCCORMACK. He is a good man?

Mr. MARCHETTI. Excellent. He is one of the well-known leaders in his field. He is a climatologist. You see, to go back to my previous situation: He was a climatologist; his specialty was climatology; yet he was also running an overall geophysics group. When I say he was a climatologist I mean by that, to borrow a term from medicine, he put rubber gloves on to actually work himself. He worked in

climatology, but as he got older and supervised younger people he broadened his sphere.

Mr. LIPSCOMB. Going back to these decisions you would make on a project, you would take them to the commanding officer. Then what process would he use in overriding your decision?

Mr. MARCHETTI. I did not say I would take it to the commanding officer. I say that I gave the results of these decisions directly to the technical people that reported to me for carrying them out.

Mr. LIPSCOMB. You said you made a determination whether a project would go ahead or not.

Mr. MARCHETTI. That is right. And the orders would come from my office.

Mr. LIPSCOMB. Did the commanding officer, the commanding general, not have to know about them?

Mr. MARCHETTI. Yes; but only by discussion with me. My office was right next to his.

Mr. LIPSCOMB. You mentioned overriding your decision.

Mr. MARCHETTI. He could override that decision, and I would not, generally speaking, on an important item, make such decisions and sent out such an order without having gotten his verbal O. K. on it, but only a verbal O. K.

Mr. LIPSCOMB. Recently your decisions have been overridden?

Mr. MARCHETTI. It was more than that. Not only were decisions overridden, but decisions were given without even discussing them with me.

Mr. LIPSCOMB. What process did he use in overriding a decision? Would he go and consult with people at lower echelons?

Mr. MARCHETTI. He would write an order. Yes, this is one of the things he did.

Mr. LIPSCOMB. He would make his own investigation?

Mr. MARCHETTI. That is right. As a matter of fact, one of the controversies we had in the Electronics Directorate was that he went to—when I say "he" I say "General Maude" went to a group of technical people, whom we had referred to—and I say "we"; I mean Dr. Schneider and myself—as a group of malcontents. They had felt that decisions given by Dr. Schneider or myself over the past 2 years they did not agree with. Obviously you cannot run a laboratory and please everyone. Occasionally you have to rule against someone.

These people met with General Maude, without Dr. Schneider having been invited or myself having been invited. I heard about this and called this to General Maude's attention.

Mr. BALWAN. Was this a conference in the office?

Mr. MARCHETTI. This was a conference in his home, in which they discussed business matters. I said, "We cannot run this place if your Director of Electronics and I as Technical Director do not know what you are discussing with these other people."

I said, "I understand you had these people at your home Saturday."

I said, "Of course it is none of my business who you invite to your home, but when it interferes with the functions of the laboratory I certainly feel that it is wrong."

We had quite some serious words with regard to this matter, and it was one of the things that broke down relationships between us.

Mr. BALWAN. In order to develop the thesis that the subcommittee is working on; namely, that we have a feeling that it is possible and it does occur that the military can take more and more control over the scientific activities; can you first tell us what are your feelings about having a civilian scientist control a laboratory; and then, after that, we will follow it with how can you explain to us that the military has come in and gradually taken control, if that is the case?

Mr. MARCHETTI. Well, over the last 9 years Cambridge has been a laboratory that has been to a large extent guided by my policies. I have been the senior civilian. I have grown with it.

What is required to keep a laboratory healthy—because a research laboratory has projects in it which sometimes have a 5-year life; sometimes have a 2-year life, and very seldom is there a project with as short a life as 8 months—generally speaking projects will go 5 or 6 years before they come to some sort of fruition which will result either in an end weapon or some piece of hardware. For that reason there should be a continuation of policy. Every time we have a new commander, it is practically like a curse. It is necessary to educate him as to why we are running down Street A or Street B or Street C on these various projects. And with the turnover we have had we continuously get a shift in orientation. This is accomplished by——

Mr. BALWAN. Before you go on to that part, where you are talking about the shift, how can you assure any kind of continuity even with a civilian technical director?

Mr. MARCHETTI. Well, it is certainly a lot easier to follow the policies that have been initiated, say, 4 years ago.

Mr. BALWAN. The question I asked was this: You say that there is too much rotation of officers because of military policy to rotate officers.

Mr. MARCHETTI. Yes.

Mr. BALWAN. And then you imply that if we have civilian directors you will not have that, since there are a lot of projects that spread over 2 to 5 years before they reach fruition. Why is it any more possible to have this continuity by virtue of having a civilian director?

Mr. MARCHETTI. The civilian directors are not changed as often; or we would hope are not changed as often as military commanders are.

Mr. BALWAN. But they are changing. We know you left.

Mr. MARCHETTI. Yes, that is true.

Mr. RIEHLMAN. May I interrupt at that point? Would the civilian director not have more background in that field of activity than the military man?

Mr. MARCHETTI. Very definitely.

Mr. RIEHLMAN. So if you did have a change of personnel in the civilian it would not have anywhere near the effect?

Mr. MARCHETTI. It would not have anywhere near that much.

Mr. RIEHLMAN. As with a military man coming in and taking over direct, who had no background.

Mr. MARCHETTI. Exactly.

Mr. BALWAN. It is possible, however, to arrive at a situation that is so bad in the military that you can have a great amount of change-over in jobs among civilian directors.

Mr. MARCHETTI. Well, this will cripple the laboratory if the civilians rotate at the same rate as the military. As a matter of fact,

I feel that the laboratory has been dealt a severe blow by losing just four men. The policies and programs started by Dr. Schneider bear his thinking and his push and drive, and certainly there is no one there that is competent to continue that type of work.

Mr. BALWAN. But why is it important to have a civilian director? You could accomplish the same thing by having civilian directors in charge of each of the laboratories you had, to provide the continuity, could you not?

Mr. MARCHETTI. Now, wait. A civilian director without an overall civilian to guide the policy—let me put it differently. I should not use the "civilian."

A man competent at the top, be he military or civilian—certainly this makes no difference if he has competence, if he knows that a geophysics program on which we are spending $400,000 is in fact less important than an electronics program on which we are spending $50,000 in its time scale—and in many instances this is possible; I have used an extreme example on dollars. He can make the decision that he will put some of his very, very, very, best people on this job with a lower dollar figure than he would put on the geophysics field. This is a decision that requires competence.

I say that from my experience in Cambridge I have never seen, with very rare exceptions—General Phillips and Colonel Mitchell—military people who are in a position to make this decision. I mean, this decision relative between one field and another field. Therefore, I use that as an argument to prove that you must have a competent man over all who can adjudicate conflicts between the three separate technical groups, and these conflicts occur in the day-by-day, week-by-week basis.

Mr. BALWAN. So we have two points here. One is that it is not only necessary that we have civilians in the program, but it is necessary that we have top civilians to give this continuity.

Mr. MARCHETTI. Correct.

Mr. BALWAN. Some of this continuity is assured by virtue of paying a man enough money to make sure that he at least can, through the voluntary process, stay on and he does not have to move on from orders of someone else. It is a part of the virtue of having a civilian director.

Mr. MARCHETTI. And to obtain the confidence.

Mr. BALWAN. With regard to the other part of our discussion, if it is desirable that we have such a civilian director, as we feel it is, and as you point out it is, we have a situation at Cambridge where civilian control was lost. I wonder if we could now develop how you feel that gradually civilian control was lost.

Mr. MARCHETTI. I think that I can do that. It was a process that took place over a period of about 7 months.

Prior to the arrival of General Maude there was a very excellent policy at Cambridge; one which, stated very simply, was that assignment of men to a job would be made upon the basis of their skill, their competence for that job, regardless of whether they were military or civilians. As evidence of that policy, we had two civilian directors and one military director. The director of atomic warfare was Colonel Jack, a very competent technical man. He was trained at Los Alamos, and we could not obtain a civilian director of competence equal to his because practically all of the nuclear physicists of any note at

all were working for either Los Alamos, Brookhaven, or the various universities. Under this system the laboratory was very healthy.

General Maude came in and decided—and I think he decided this slowly—that key positions in the laboratory were going to be filled by military folk.

Mr. BALWAN. How did you get that impression?

Mr. MARCHETTI. I got that impression by virtue of the fact that he brought in military people and gave them assignments where civilians had operated before.

Mr. BALWAN. How about giving us an example.

Mr. MARCHETTI. He brought in a Colonel Brown and insisted that Dr. Schneider make him his assistant. Dr. Schneider looked over Colonel Brown, as well as I, asked him a few questions, and we determined he did not have the capability, the technical capability, to be his assistant, and gave him an assignment that was not Assistant Director but a lower level job, one that he was fitted for.

Mr. BALWAN. What was that job?

Mr. MARCHETTI. That job was assistant to the components section of electronics. It is about two echelons below.

Mr. BALWAN. An administrative job?

Mr. MARCHETTI. Yes.

Mr. BALWAN. Nontechnical?

Mr. MARCHETTI. Nontechnical. He had some technical ability, but not very much. The key positions at the center—when I say the "center" I will call this the administrative section of the offices that oversaw the entire center—were replaced by purely military people regardless of their technical competence.

Mr. BALWAN. Where was that?

Mr. MARCHETTI. The headquarters center. In there we had some officers with technical competence. For instance, I had working for me another Colonel Brown, who was an ex-professor at Massachusetts Institute of Technology, although in uniform.

Mr. BALWAN. Doing what work?

Mr. MARCHETTI. He was 1 of my 3 assistants.

When General Maude came in, he had not been there a week when he transferred this man to Wright Field. The man had been with us about 6 months. I felt that it was wrong. However, since he was a military man who did report to me I did not make too much of an issue of it, though I felt, shall I say, practically insulted that he should take a man who reported to me and order him out of the station without asking me about his leaving.

Mr. BALWAN. I am getting the impression that somewhere communications between you and General Maude broke down early in the game.

Mr. MARCHETTI. They never existed.

Mr. BALWAN. From the first day?

Mr. MARCHETTI. Shall I say, he just did not believe in the principles we had been operating under under General Phillips.

Mr. BALWAN. You never felt from the time he arrived there that you and he had any communication?

Mr. MARCHETTI. I attempted this: When he first came in we had a very frank discussion. I told him how we were operating. I told him how Phillips and I operated and how the station was going and what our problems were. I said, "Do you feel that you agree with this?"

He said, "Yes, I agree. I would like to make some very minor changes. There are a few officers that I am used to having on my staff and I would like to bring them in and make some spots for them."

I said, "I have no objection to that."

He did bring the people in. However, after he had been there about 3 or 4 months one could see by his day-by-day actions——

Mr. BALWAN. Nothing of a personal nature happened that would make you and General Maude have difficulties and not feel close to one another?

Mr. MARCHETTI. No. I do not think that I ever knew him as well as I knew Phillips. He was a person that you did not get to know very well, whereas the other was very friendly.

Mr. BALWAN. You accepted the idea almost from the beginning; you could sense there was not too much rapport between you and him?

Mr. MARCHETTI. I sensed it the first week when he made a reassignment of one of my assistants.

Mr. BALWAN. Did he make any statements of any kind that would give you the impression right at the beginning that you were going to have a hard time?

Mr. MARCHETTI. Not at the very beginning. The first thing he did to me that really indicated we were going to have a hard time was after he had been there about 6 months. My office was right next to his office. We were going along with business as usual. I was doing my best to educate him on what our program was and what our difficulties were, and how we were trying to get things done. Then he published an order. This order was delivered to me by his aide, and this order removed me as Technical Deputy and put me off to the side as an assistant for research and development.

I said, "What is the meaning of this?"

Mr. BALWAN. You were the Technical Deputy?

Mr. MARCHETTI. Yes.

Mr. BALWAN. The next change was what?

Mr. MARCHETTI. The next change was to make me assistant for research and development off to one side.

Mr. BALWAN. Did it change your duties at all?

Mr. MARCHETTI. No.

Mr. BALWAN. Did you ever hold title as Technical Director?

Mr. MARCHETTI. Just a moment, I will get to that. So I said, "I am surprised at this, Ray. What did you make this change for? Why did you not discuss it with me? Why publish an order and just drop it on my desk? We are just right across the hall here."

We had adjoining doors. The offices were right next to each other.

I said, "I do not agree with this. I feel that if I am to have any authority here I belong in the organization chart and not apart from it."

Mr. BALWAN. Were you told that that took you out of the line of authority, or command?

Mr. MARCHETTI. Just a moment. He said when I brought this discussion up to him: "John, a civilian cannot be in the chain of command."

I said, "What do you mean 'a civilian cannot be in the chain of command'?"

He said, "I mean just exactly that."

Despite his statement, which is very, very strong, I said, "I do not understand why a civilian in the technical laboratory cannot be in the chain of command."

We argued this point 4 or 5 days, and then he conceded putting me back in the organization chart the way it was, but insisted on changing my title from technical deputy to technical director. He felt that the deputy had a military connotation which was distasteful to him. I said, "I have no objection to that, you can call me anything you like, but I want to know that there are 3 people in this organization, the 3 directors reporting to me and that I have some real authority here and I am not just an adviser to you."

Mr. BALWAN. Besides these events, was there any other way by which you got the impression that he was apt to make changes which you felt were not attributable to any one thing you did? I am trying to do this: To establish whether he was doing these things because he did not like John Marchetti, or whether he had a philosophy about running this show in his way through military means. Right now, it is very easy to get the idea that there may have been a personality conflict and I would like to find out from you to establish definitely that he was carrying out a way of operating a laboratory.

Mr. MARCHETTI. For me to say there was no personal conflict between General Maude and myself is not correct; we disagreed. There is a conflict, whether you call it personality or not. However, the actions he took directed at me as senior civilian—these actions that I am talking about where he moved me out of the block and changed me from deputy to director—he took similar action in the directorates themselves. There was one in geophysics; there was one in electronics; there was even one in atomic warfare in a varying degree. The one in geophysics was one where a group of geophysic laboratory chiefs, people from the group subordinate to Dr. Lansburgh, made arrangements for a meeting to talk to General Maude without Lansburgh being present. This was condoned by General Maude. He felt this was the proper way to run the laboratory, and yet Dr. Lansburgh felt very hurt about it. He felt his subordinate people were being encouraged by the front office to run end on him. Mr. Metz in the atomic warfare division had a fair amount of——

Mr. MCCORMACK. Suppose that they had a complaint.

Mr. MARCHETTI. Yes.

Mr. MCCORMACK. Your position is that decency would call for Dr. Lansburgh being there?

Mr. MARCHETTI. Yes.

Mr. MCCORMACK. In an organization you would think that the decent thing to do would be to have the man against whom the complaint was made present at the same time?

Mr. MARCHETTI. That is right. The senior civilians in the chain of command who had formerly been bossing these people were being short-circuited at every opportunity and the military were going direct to them and encouraging them to come direct. It was just undermining the complete authority of the civilians at the station.

Mr. BALWAN. This was not a localized situation directed at John Marchetti?

Mr. MARCHETTI. No. It was directed at Dr. Schneider, which resulted in his resignation; it was directed at Frank Metz. When I say directed, it occurred there. Whether it was directed at him as an

individual or not, I do not know. I actually do not believe so. I do not think that General Maude feels this is the way to run a laboratory. He feels it is his prerogative to go any place he likes and encourage anyone to come into his office to talk over matters, and the resulting chaos was that no one knew who was the boss, whether Schneider was the boss of electronics, or the military.

Mr. BALWAN. Did you hear from any other sources any other information that led you to believe that he was coming to Cambridge to reorganize along military lines?

Mr. MARCHETTI. No, I did not.

Mr. BALWAN. Proceed to develop how you felt that the military in this case study was taking control.

Mr. MARCHETTI. The center's headquarters, as I maintained before, was a group that, generally speaking, provided the administration for three technical groups. Under the operation that I feel is correct this was essentially a supporting structure, but not a bossing structure, or an administrative control function over the laboratory. That is, Dr. Schneider and Dr. Lansburgh were allowed a great deal of autonomy in making their own decisions. After General Maude came in a great deal of that authority, both budgetwise, plans and operationswise, and commitments with outside laboratories—which is the heart of what we do—had to be controlled by a central staff. He took authority from electronics, from geophysics, and from nuclear physics and centralized it in his military staff headquarters. This resulted in the technical people finding that they had to get authority from colonels in the staff headquarters on matters they had previously decided themselves, and that they were most competent to decide.

In addition, this superstructure of colonels, who in most cases knew very little about what they were doing technically, just added to the administrative redtape. It got to the point where it was nearly impossible to get anything done because one was continually explaining to them why a budget change had to be made on a particular project. If something came up on a project that required a technical change and a corresponding dollar change, it was like pulling hens' teeth to get it done because it had to be approved through the planning and operations organization where there was a colonel; it had to be approved through the budget and fiscal office in which there was a colonel, and I, from my position as technical director, had no longer any more control to go into the budget and fiscal office and say, "Do this," because Dr. Schneider's projects B, C, and D are in this sort of difficulty, and it requires this transfer of funds, whereas I had been able to do that before.

As a matter of fact, normally, they would have done this on a request from the director.

The situation was one that deteriorated and deteriorated, and it is pretty hard to put your finger on any one thing.

Mr. BALWAN. Do you believe the situation is now one where the laboratory with the center is definitely guided by military rather than civilian scientists?

Mr. MARCHETTI. Very definitely. The center headquarters is thoroughly militarized.

Mr. BALWAN. What is your opinion of the steering committee that has been developed in planning the work of the directorates? Can it do the job?

Mr. MARCHETTI. I do not think so.

Mr. BALWAN. Why not?

Mr. MARCHETTI. I would hate to use a cliché and say a committee never gets anything done, but in a laboratory where you have to make some spot decisions, and they have to be sometimes pretty quick, it is rather difficult to get a committee to work. They did at one time try to run Cambridge with a steering committee and that was in the early days when it was the Cambridge Field Station. This turned out to be a total flop because no one would take the responsibility. The three-man committee finally resolved itself——

Mr. MCCORMACK. The present committee is three-man? General Maude said five.

Mr. MARCHETTI. I am excluding him and——

Mr. MCCORMACK. He included himself and his deputy.

Mr. MARCHETTI. Right, and three directors.

Mr. LIPSCOMB. There were six really, and his secretary.

Mr. MARCHETTI. You find yourself in this situation: The first meeting of that so-called steering committee involved getting a decision that meant splitting some common resources. They happened to be manpower spaces. The directorate of electronics wanted them all; the directorate of geophysics wanted them all, and the directorate of nuclear physics, wanted a small portion. He had only a small group, about 30 men, but he wanted some, and they just could not come to an agreement.

The net result was that the steering committee operated by General Maude making the decisions, which is the way I think that he intends to operate.

Mr. BALWAN. We have been told that a great many of the responsibilities formerly centered in the Office of the Technical Director have been shifted to Deputy Chief of Staff for Plans and Operations as well as some that went to the steering committee.

What is your comment on the ability of the Deputy Chief of Staff for Planning and Operations to do that job?

Mr. MARCHETTI. I will be nasty and say zero. I know the man he has assigned there. The particular man just has no technical background. He is a pilot and cannot make these decisions. He is a very fine fellow. I personally know him, Col. Bill Adams. But to throw that responsibility on him, he just does not have the background for it.

I think he could struggle along for awhile because he has, as a helper, one of my ex-assistants, a Mr. Jones.

Mr. MCCORMACK. Was Mr. Jones doing the thinking?

Mr. MARCHETTI. That is right. That is Mr. Jones who used to be one of my assistants and is now his assistant.

Mr. MCCORMACK. Is not that life, where a man is put into a position of responsibility—and I am not talking about this particular colonel—and he is not qualified to do the job, he has to lean on someone else, and to that extent, while he may ostensibly be making the decisions, the other fellow is actually making them?

Mr. MARCHETTI. I do not think that Bill Adams is satisfied with that situation. I think it is one that has been thrust upon him.

Mr. MCCORMACK. I was not talking about him. I was just talking in general.

Mr. MARCHETTI. Yes. This is the way that most of our Air Force laboratories work.

Mr. MCCORMACK. Can you take men from the service, no matter how eminent they are, how good they are, how qualified they are and stick them into research?

Mr. MARCHETTI. I do not believe you can. When you do you wind up with a second- and third-grade laboratory. Generally speaking, the Air Force laboratories—and I will take Wright Field as an example; it is one of the oldest of the Air Force laboratories—you will find there that they have groups on propulsion, groups on electronics, groups on antennae, and you will find the chief of these various laboratories is either a captain, a major or a colonel. In some cases these people are competent to hold their jobs, but there are very few such cases.

Down in the fine print you will find some civilian. He is the fellow that is really running the show, but he is a second-rater or a third-rater because no first-rate technical man will go into a laboratory structure where the chief of the laboratory is a titular military man and he has to carry the responsibility without having any of the authority.

This is the reason why the military laboratories with that policy are dedicated to be second- and third-rate laboratories. No competent people will go into such an organizational structure. It is the continual cry on the part of the military that they cannot entice capable technical people to work for them. But this is utter foolishness when they put captains and majors or even full colonels in there as superiors just by virtue of their military rank. That is the heart of the problem. That is the reason why Wright Field is not a good laboratory. At Cambridge this did not obtain prior to the arrival of the last commander.

I had hoped that the Air Force would see the light, would go and change gradually, because it has to be a gradual process. I had hoped that the Air Force would change the policy to fit the Cambridge pattern, where a fair amount of authority—and let me even put it this way, just plain ordinary courtesy and equality was allotted to the technical civilians. If they had changed their other laboratories to follow the Cambridge pattern, we would have a healthy condition.

I find, however, after General Maude came in and the conversion took place, Cambridge was made to follow the pattern that was established in the other laboratories where the control was fully military and the scientific people were asked to work for a continually changing, inept and sometimes pretty irresponsible military organizational structure. I think that is the very heart of the problem.

Mr. BALWAN. What were the functions of the Deputy Chief of Staff for Plans and Operations while you were there?

What kind of work did you do?

What kind of work did they do?

Mr. MARCHETTI. The Deputy Chief, Plans and Operations, while I was there—and I want to make this the longest time I was there—was never operations. This is one of the changes made by General Maude. He was normally the Deputy Chief, Plans, not Operations.

Mr. BALWAN. What did that involve?

Mr. MARCHETTI. The Deputy Chief of Staff, Plans, was an office that kept a record, budgetwise, of future jobs for facilities, budgets and manpower.

Mr. BALWAN. Did they review projects?

Mr. MARCHETTI. No. They were considering jobs for the future, plans that were coming in. They obtained information from geophysics directors, electronics directors, people throughout the laboratory structure that had plans for the future, a job, say, on transistors that was to be done that required so many dollars and so many men, and they collated that information internally and they also obtained this same type of information from our headquarters.

Mr. BALWAN. Where?

Mr. MARCHETTI. Baltimore. Baltimore would write in and say, "Look, we want to do this job or that job as soon as you have time or as soon as you have resources." Or they would say, "Can you do this job in a certain time?"

Mr. BALWAN. What would happen when that letter would come to the Deputy Chief of Plans?

Mr. MARCHETTI. He would look over the available resources and study it to see if we could do it and put it in chart form. He made no decisions as to whether these plans would be followed out. He would assemble the information, let us say.

This was the normal function for the Office of Plans, as we called it, while I was there.

While I was there, this was merely the function of plans. They did not have the function of operations.

When General Maude came in, he changed this to plans and operations.

Mr. BALWAN. When was that changed?

Mr. MARCHETTI. That could be documented. I am sure he had an order on it. I would say within 3 months after he arrived.

Mr. BALWAN. He introduced the operations office into that original office?

Mr. MARCHETTI. Yes; whereas, prior to that, operations had been my office overall, the three directors did their own operations.

Mr. BALWAN. Did that Operations Division within that block begin immediately to take on some of your functions?

Mr. MARCHETTI. Yes.

Mr. BALWAN. They did immediately?

Mr. MARCHETTI. Yes.

Mr. BALWAN. In what way?

Mr. MARCHETTI. Mail was routed to them that required decision and they were contacted directly.

Mr. BALWAN. Is that bad?

Mr. MARCHETTI. I objected to it. As a matter of fact, my assistant, Mr. Jones, was requested by General Maude to move into the Plans and Operations Office and I asked him to do this, to go along with it since I could not dissuade General Maude that this was bad practice. And, despite the man's desire not to do it, because he felt the structure that was operating was perfectly adequate, he stayed there for three or four months beyond the period. For a while I worked on and thought General Maude would drop this matter. About the time I found out he decided to abolish my office, I also found that Mr. Jones, in organizational function, had been transferred to the other office 3

months previously, even though he continued to work out of my office and take orders from me.

It was a harum-scarum deal.

Mr. BALWAN. Might there not be adequate leadership now, even with the steering committee when the former man is in the Deputy Director's office?

In what way does this break down?

Mr. MARCHETTI. Let us look at it; the steering committee itself cannot make controversial decisions. Those decisions have got to be made by General Maude. Therefore, my most important functions have been usurped.

Mr. BALWAN. By General Maude?

Mr. MARCHETTI. Personally. He has got to make those decisions.

Mr. BALWAN. He assumed he was as capable as you in making those technical decisions?

Mr. MARCHETTI. This is correct. The Plans and Operations Office cannot do operations. All it is, is an office that is titulary operations, but it has not the competence to do it, with the exception of Mr. Jones.

Mr. Jones never, while I was there, gave a single, solitary order to Dr. Landsberg or to Dr. Schneider.

Mr. BALWAN. Mr. Chairman, I have here a statement of duties of the Technical Deputy as it was understood by Mr. Marchetti when he held that title.

Is that the correct one?

Mr. MARCHETTI. Yes.

Mr. BALWAN. I think that would be helpful for the record if we could insert that in the record.

Mr. RIEHLMAN. Without objection, it will be inserted in the record at this point.

(Duties of Technical Deputy are as follows:)

STATEMENT SUBMITTED BY MR. J. W. MARCHETTI

The technical deputy is responsible for the quality of technical work conducted by the laboratory (usually measured as the technical reputation of the laboratory by other workers in the field) and the utility of the results to the Air Force on a long-term basis (3 to 5 years). He must use all means at his disposal to accomplish this. This short and simply is all there is to the job. However, a description of how this is done on a day-by-day basis, particularly in a military laboratory, is much more involved and probably what you would like to know. I list below in synopsis form these details of duty as they come to mind and not in any relative order of importance. Later I will describe each more fully and for ease in cross-referencing will use the same numbering system as that used in the synopsis.

1. Initiate and cut off technical programs.
2. Maintain balance between the fields of electronics, geophysics, and atomic warfare.
3. Estimate the long-term value of each project.
4. Conduct budget defense.
5. Maintain contacts with university and industrial labs working in allied fields.
6. Sell management on the advisability of programs.
7. Help commanding general establish and guide center policies.
8. Conduct the annual project by project review of all 3 directorates, with the aid of 4 outside consultants.
9. Assist the Directors on difficult personnel problems.
10. Make decisions on areas of conflict between directorates.
11. Coordination with other Air Force labs.
12. Know the "in house" capability of the center research team.
13. Review technical programs of foreign governments with a view to adjustments in our own programs.

14. Technical coordination with Project Lincoln.
15. Attend meetings of the Air Force Scientific Advisory Board.
16. Initiate action for promotion of division directors.
17. Attend ARDC commanders' conferences.
18. Keep a very close eye on trouble areas within the directorate and when necessary use the authority vested in the position to back the directors.
19. Be aware, completely as possible, of any new scientific advance that may have a military application.
20. Speak, as occasion demands, at conferences (industrial, academic, or Government) on center subjects of interest.
21. Coordination with Air Force using commands' customers (Air Defense, Tactical Air, SAC).

Before giving further details on the above 21 functions I would like to make a few general remarks about the job of technical deputy. It is a job where authority must be the vested and recognized boss but never bossy. A research and development laboratory is a place where creative work is done and probably the most ridiculous thing one could do is to command a group of men to create for their weekly paycheck. In a creative group even the use of the word command is abhorrent, there is plainly nothing to command. It is a job of guidance and leadership, that, when successful, gets the most out of the men that is possible.

Mr. McCormack. The important thing about a man in science is that he must have demonstrated ability to think originally, isn't that right?

Mr. Marchetti. Yes.

Mr. McCormack. They are discovering things and looking ahead maybe 10 and 20 years sometimes.

Mr. Marchetti. That is right.

Mr. McCormack. I have an article that appeared in Business Week under date of June 5, 1954, on the development of research in the General Electric Co. and that laboratory of theirs expanded from a small barn not so many years ago to a tremendous activity. It is a very interesting article and I will give it to you because I think the background is interesting.

The selection of projects is, of course, a very important matter and then there is the man who has the administrative ability in that particular field. the administrative scientist, I believe you would call him.

Mr. Marchetti. Yes.

Mr. McCormack. He is an important man and the teamwork between scientists and management and the liaison between the scientists and the military must be bridged, and one of the suggestions General Electric have, for example, is to set up a special evaluation group to look over all suggested projects. The group would first check the projects that seemed most needed or most promising to them to see which would go to the central laboratory and which to the division laboratories.

The groups would be made up of men whose pooled knowledge would embrace the physical sciences, research and economics. In making its decisions, it would draw on opinions of the men concerned with each project—from scientists to division sales manager.

Then, of course, there has got to be somebody making decisions. So, this is a growing field, isn't it?

Mr. Marchetti. It certainly is and a very important one to the military laboratories. I do not believe that there is any difference of opinion on this score, either between the military folk, good and bad, who have come to Cambridge in my experience.

Mr. McCormack. You mean good and bad from the standpoint of research?

Mr. MARCHETTI. Yes, they all agree that the laboratory will be as good as the quality of the people they have. The trouble is that they do not understand what is required to get and to keep and to attract good quality people. They want it but they only give lip service to it. It is like wanting to go to heaven. I don't think they quite know how.

Mr. MCCORMACK. It is admitted that you are an excellent electronic man. That is the testimony received by the committee. I am talking now about testimony and not the weighing of it or the evaluating of it, but in your position as Technical Deputy or Technical Director, whichever you want to call it, you were Technical Deputy first.

Mr. MARCHETTI. Yes, sir.

Mr. MCCORMACK. With authority and with responsibility and you found yourself Technical Director, according to your testimony, without authority and responsibility, is that correct?

Mr. MARCHETTI. That is correct.

Mr. MCCORMACK. The committee has received some testimony that while you had a knowledge of atomic arms and of geophysics, that it was not sufficient for you to occupy the position of Technical Deputy or Technical Director.

What is your answer to that, assuming that was the evidence or some of the evidence?

Mr. MARCHETTI. Well, that is a very difficult question for me to answer. I admit frankly that I am not a detailed expert in geophysics or in nuclear physics. However, my 16 years of experience in the physical sciences, which is a general thing, I feel is adequate background for that purpose, for that job, and if I remember correctly, I was recommended for that job by Dr. Stratton, of MIT. I think this is the reason I got it, actually that the assignment was made.

I point as a parallel to this, that the dean of a university, or that the dean of a school of engineering, is not particularly an expert in chemistry or in physics, and yet they do have overall men for these scientific groups.

This is the sort of a job that the Technical Deputy's job was. It was not one that involved the detailed technical supervision of that field. That field was managed, in detailed supervision, by a specialist on the job in the field.

You cannot find a man, be my qualifications adequate or inadequate, and I will not argue that point—one cannot find a man skilled in every field who can be put in as a supervisor.

Mr. MCCORMACK. Whether he is highly skilled in one field, would the knowledge of the others assist him?

Mr. MARCHETTI. It is bound to spill over, especially in the technical sciences. You would not take fields that were unallied, for instance, a medical group and a physical science group. They would not be allied.

Mr. MCCORMACK. Without regard to who filled the position, but based upon your knowledge of experience, have you an opinion as to whether or not the position of Technical Deputy or Technical Director is important and necessary at the Cambridge center or is it unnecessary? Could it be eliminated? And, having in mind, of course, the military for the scientists.

Mr. MARCHETTI. I do not think it can be eliminated. I would like to go back for a moment and say that if General Maude felt that I was incapable of supervising the fields other than electronics, he did not, in replacing me, obtain a man who was. He just abolished the position.

So that this is hardly an argument, I feel. He felt that the job was unnecessary. I know of no laboratory in industry that operates without a senior technical man at the head of it. How a military laboratory can be any different in handling electronics and physical sciences than a college laboratory or an industrial laboratory, I do not understand. The function exists. It just cannot run without a head. You try to run it with a committee structure and that is impossible. I think it merely begs the question and gives the committee the titular responsibility where the factual responsibility rests with the commander.

Mr. MCCORMACK. The best assurance of continuity of understanding is where there is a continuity of employment with a representation on the civilian side at a high level.

If you had a military man who is completely competent, there would be no objection.

Mr. MARCHETTI. That is right.

Mr. MCCORMACK. But there is a rotation. Is it your opinion that with due respect as you have and I have for the military and no desire to change the fact that the military is in command, but that it is advisable that there be in the highest echelon of responsibility and control a competent civilian and civilians?

Mr. MARCHETTI. I am fully convinced of this. I go one step further and say that in my 16 years of experience with military laboratories, the only hope is to make them completely civilian-controlled. I see no reason, absolutely no reason, for having the military within the laboratory at all.

We have, and I do not want to give the impression in saying this, that the job is not being done for the military because in fact it is, we have grown up within this type of split laboratory structure a group of military people who are neither operationally capable nor scientifically capable. I call these people pseudo scientists. We need such people not at all.

There are military people who have operational ability and who can complement technical people. They can come in and say that this fire-control equipment works well or works poorly, and that they would like to have it changed. But when they come in and decide that they will design this fire-control equipment with this type of packaging and that type of antenna, they are out of their element. They are not skilled enough to make these scientific decisions.

So that if we could divorce the military and put them in the fields which they have competence for, which is the operational end use of the item, both in criticizing it and asking for changes in it, or even asking for new designs, this would be a field in which they could be very useful and they would get more themselves. They would not have to live essentially a lie that they are technically competent because they are not, on the average. There are exceptions, of course, because occasionally there are in uniform very capable scientists but not enough to keep our laboratories in a healthy structure, so I feel the end result is to divorce the research and development design work.

The research and development should be completely under the control of civilian people who have their jobs on the basis of their

competence, and alongside of them a customer group of military people who say, give us the output that you produce. We will try it and use and if we do not like it, we will tell you. But when they come in to try to tell us how to build it, that messes up the entire thing.

Mr. LIPSCOMB. Why should there be any Government laboratories, under your plan?

Mr. MARCHETTI. This is a very good question. The answer to it is very simple, because if one were to split the work among industrial laboratories and universities laboratories, these people can only get a part of the job by virtue of the fact that you are distributing it. It is distributed today because the Government laboratories only do a small pittance of the total job.

One group of so-called inhouse laboratories or Government laboratories has got to know the entire picture.

For instance, if you are in company "X" doing a research job on a fire-control equipment, you have got to go to someone who knows the entire overall program. The only way this could be done would be to farm out to industry or to the universities where there would be no military control.

These different jobs might go to different companies like A, B, and C, the fire control, the long-distance radar, the "Met" instruments, and nuclear physics. You would have to go to one of these people and say to that person that he would be the one who would provide the cohesion. This can be the agency in which you decide which pieces go to group A, the Philco people, and which pieces go to the Bell Laboratories and how they merge together.

I think that a certain percentage of this must be done by laboratories completely under Government control.

Mr. MCCORMACK. Isn't applied research and development and engineering dependent in the first instance upon basic?

Mr. MARCHETTI. They are. The basic research is generally done by the university laboratories, sometimes with Government support, and a fair portion of it without Government support.

Mr. MCCORMACK. You have testified as to your viewpoint on civilian control up to a certain point. That could include some basic applied up to the development.

Mr. MARCHETTI. That is right.

Mr. MCCORMACK. The engineering is getting into production.

Mr. MARCHETTI. Yes; this is generally done in industry.

Mr. MCCORMACK. Under the present setup you have given your testimony on your own views. But having in mind the present setup, what are your suggestions with respect to the present setup? What suggestion would you give to the committee that you think would constitute an improvement, assuming that you have got to have the military in there?

Mr. RIEHLMAN. Mr. McCormack, I wonder if we could give the gentleman an opportunity to write that answer out for us. I think he might give us some very constructive suggestions, instead of giving it off the cuff.

If it is agreeable with you, I would like to give him time enough to do it.

Mr. MCCORMACK. Absolutely.

Mr. MARCHETTI. I would be delighted to do it.

Mr. MCCORMACK. We are concerned with what is for the best interest of this country of ours, and in this particular field, and how we

can go ahead, having in mind that we are all human beings, how we can get the maximum results desired.

Mr. RIEHLMAN. I think that would be fine if he would take the time to do it for us.

Mr. MARCHETTI. I would be delighted to do it.

Mr. RIEHLMAN. I do not want to interrupt your line of questioning, Mr. McCormack. I thought that was important enough that we should give him a little time to give us the answer that he would like to.

Do you have any other questions, Mr. McCormack?

Mr. MCCORMACK. No, I think that answer which he will provide would cover it.

Mr. RIEHLMAN. Mr. Balwan and I discussed this matter a moment ago and we would like to ask you why you think, in brief terms, your job was abolished? Is there any other phase that you have not covered of why your position was abolished?

Mr. MARCHETTI. There are other parts of the controversy that are detailed, but I cannot state to you at this point because I do not feel they are as germane as the points that I have brought out. I think they are part and parcel of the same general policy, if you like, that all of the senior civilian jobs in one way or another will have to eventually, within the Air Force, be converted to military jobs.

I feel that my position was abolished and that the directors under me were weakened in their position and the military strengthened as a general policy. The methodology was slightly different, but I see in this an overall pattern.

A large portion of the senior civilians of the Air Force have left the service; Mr. Cole at Rome, N. Y.; Dr. Art Warner from Patrick Air Force Base, Fla., and the four I have already mentioned from Cambridge.

The stories are all slightly different but they all fit a general pattern.

Mr. RIEHLMAN. That the military wanted to move in and move out the civilian director?

Mr. MARCHETTI. Yes.

Mr. MCCORMACK. They talk about the operations being about the same as in private industry. I think counsel asked some very pointed questions of other witnesses about the effect of the turnover among the leaders in the field of science. You refer to those in the higher classification bracket who are hired by reason of their ability.

What effect does the resignation—and leave yourself out of it—of Dr. Landsberg and Dr. Schneider, have on Cambridge? I left you out because I felt that you might be hesitant to talk about yourself. But will you give the committee what effect the resignation of Dr. Landsberg and Dr. Schneider had on Cambridge?

Mr. MARCHETTI. It had a very serious effect. The facet that I consider most serious was on the younger men inside the organization who felt that there was a great deal of instability. They were used to Dr. Landsberg and Dr. Schneider, and now they suddenly see them go. They know they did not go on a pleasant basis but on a rather unpleasant basis and they feel, this is no place for me, why should I stay in such an organization, perhaps move up to the top and then find myself in the place they are in. I think there is another ill effect on the people on the outside. Those scientists who are on the fringe who might be considering or might be available to come into the laboratories. Such people on the outside will be dis-

couraged who might say look what happened at Cambridge and Rome. Look at the fracas. I don't want to get into that.

You have the people inside, annoyed and anxious to leave, and the people on the outside who will not come in.

Mr. RIEHLMAN. Another very serious point, too, is the effect it would have on the project under study.

Mr. MARCHETTI. This one, of course, is very obvious.

Mr. MCCORMACK. What about the difficulty of getting men of their qualifications?

Mr. MARCHETTI. I think it will be extremely difficult.

Mr. MCCORMACK. Have they got them?

Mr. MARCHETTI. No; they do not. To the best of my knowledge, they have a young man whose previous job was assistant director in a group of psychologists heading the electronics department.

Mr. MCCORMACK. Is that called the Human Factors Research Center?

Mr. MARCHETTI. Yes. He is a very nice lad.

Mr. BALWAN. Is he an electronics man?

Mr. MARCHETTI. No; he is a psychologist. He is acting head and, as I understand it, they have this man aided by Colonel Brown since Dr. Schneider and I have resigned.

Mr. BALWAN. We will have as a witness Dr. Frick, who is the acting director and who will appear tomorrow morning.

Mr. RIEHLMAN. Is he the psychologist?

Mr. MARCHETTI. Yes.

Mr. MCCORMACK. What about the other divisions?

Mr. MARCHETTI. As you may not know, the nuclear physics division was dissolved in toto. That was through a conflict with the Navy and some of the people were sent to California. There is no senior man presently head of geophysics. Dr. Landsberg, before he left, suggested a man for the job, Mr. Wyckoff, one of the laboratory chiefs. He is one of the most capable junior men of six. Mr. Wyckoff refused the job, and so far as I know, that job is still open. My knowledge is not too complete on that. You can find that out from General Maude or other people in the organization.

Mr. BALWAN. When we sent this list of questions to various people concerning problems which are reported to exist in the research and development program, we sent this list of questions to Mr. Marchetti, Mr. Chairman. They are very pertinent and I would suggest that we insert them in the record at this time rather than to discuss them further at this time.

Mr. RIEHLMAN. Is that agreeable to the subcommittee?

Mr. MCCORMACK. In other words, if these questions were asked you, is this the way you would have answered them?

Mr. MARCHETTI. Yes; I certainly would.

Mr. RIEHLMAN. They will be inserted in the record at this point, without objection.

(List of questions referred to is as follows:)

LEXINGTON, MASS., *7 June 1954.*

HOUSE OF REPRESENTATIVES,
Military Operations Subcommittee,
Committee on Government Operations,
Washington, D. C.

DEAR SIRS: In answer to your letter of June 2, 1954, I accept your invitation to appear before the subcommittee on June 10 to provide whatever information I have which may be of assistance in your endeavors.

As suggested in your letter I am submitting herewith my written answers to the list of questions provided by the subcommittee. They are as follows:

1. Yes, there are characteristics inherent in military organizations incompatible with research and development.

(*a*) Rotation of officers on a 2-year cycle does not match the research and development time cycle, practically no results of significance can be obtained in so short a time.

(*b*) The military policy of placing officers in their research and development establishments on the basis of their rank rather than their experience for the job causes continuous transients to occur in the laboratories to the relatively permanent party of civilians particularly at the higher levels. It involves a series of stop-and-go operations with every change of commander.

(*c*) Military operations are generally well planned, routine functions as exemplified by their well-established tables of organization and equipment. Research and development laboratories, by their very nature, handle the nonroutine and seldom is the same job done twice. If the laboratory is healthy it is ever reaching for something new and to officers trained in military organizations this seems chaotic. They feel it their duty to put the houxe in order. When they do, they stifle enterprise, and effectively kill the goose that lays the golden egg.

(*d*) The classical struggle between civilian and military is a point that cannot be blamed entirely on military organizations since a fair share of the fault rests on the civilian side. However, it is an important facet of the problem, that is often ignored, more pleasant not to talk about and often outright denied by people who know better. Junior civilians and junior officers are generally more guilty of this than the senior people, but its effect on the morale of a laboratory is insidious. It is one clique pitted against another, where both feel they are right. There are hundreds of ways in which it is manifest; at the officers club on a research and development base, the civilian feels out of place and at a civilian dance, the officer in turn feels out of place. The following quote indicates the depth of feeling that exists: "It is said of a well-known Air Force research and development that at the officers' club the relative ranks are officers, enlisted men, dogs, and civilians." The snide undercover remarks, made on both sides could fill pages, but this problem existing in varying degree at every military research and development establishment cannot be overlooked or allowed to drift. As a sporting competitive spirit it can be tolerated, but where the very security of our country depends on the morale and effectiveness of our military research and development establishments, this condition must be squarely faced up to and solved.

(*e*) Military organizations, for some obscure reason, have never treated well in their promotional scheme those few officers who have shown real competence, either in doing research itself or managing research. In many cases, known to me, these officers have been driven out of the service. This is probably rationalized as a military policy harking back to war conditions when officers were trained for any emergency. In an age of specialization, particularly in the technical fields that ever become more complex this seems to me an overdeification of "L'uomo universale."

2. Military organization of research and development does create conditions which retard the work of scientists. One could sum it up by saying that within our military research and development establishments civilian scientists are considered as working for the military rather than with the military. It is the subtle difference between these two attitudes which is all controlling in the retention of highly qualified technical personnel in said establishments. To be specific I list a few examples:

(*a*) The organization charts must all fit a set pattern. At AFCRC it has practically become a joke. Instead of letting the chart show as closely as possible what the real functions are, there is a wide divergence between the official chart and the unofficial or working organization. As some civilians have put it, "Let's stop arguing about it, let them draw any damn wiring diagram they want to, they like to do it and it will keep them out of our hair."

(*b*) The redtape engendered by officers who have too little to do, results in overreporting and general overadministration. I am not here talking about the lazy officer, but rather the run-of-mine officer who having been assigned to a research and development establishment is doing his best to find out what it is all about, probably trying to be useful in a job he does not understand, and inwardly looking forward to his day of reassignment.

(*c*) The general bossy attitude and correcting of faults by issuing another order or regulation inherent in a military organization is incompatible with the scientific mind. It usually results in a set of rules or laws, so voluminous that no one reads them and a feeling by the technical people that they are being treated like children.

3. I feel it is absolutely necessary to establish a civilian organization to administer military research and development if the present emasculated conditions are ever to be corrected. Military participation is of course necessary, but they need not be a part of the organization or its administration. The military as customers can ask for certain developments that they deem desirable; they should criticize equipments and make suggestions for their improvement operationally; but their authority within the actual creation of the research and development items should be reduced to zero. Many times new military equipments come from the technical people themselves and in those cases, the devices should be turned over to the military for their operational appraisal. Such a separation would leave each n his own environment to thrive. In such a separation both military and scientist would be better off, each would be doing a job he understood and real mutual respect should obtain. Under such a system operational military would be attached to the laboratories on a liason status and civilian scientists, in turn, on liason to military units when necessary.

4. It is feasible to have technical activities performed by a civilian organization supported by a military organization. Both Britain and Canada have adopted such a system and there is an example of this in the United States as well. The Lincoln laboratory, wholly civilian operated, obtains its test flying from a military organization at Bedford Airport.

5. The Department of Defense has so large a research and development load that it must contract with nongovernmental institutions to get its job done. "Inhouse" Government research and development must be done not only to provide qualitative control over outside work, but to give guidance and make the overall program cohesive. As a guess, I would estimate that the "inhouse" effort, on a dollar basis, would be dangerously small if it fell below 25 percent of the total effort. Nonprofit and profit institutions have been very helpful in the past and their capability should be used and maintained. There is a growing tendency to throw an excessively large burden on university laboratories, since in most cases they provide the ideal atmosphere for getting the work done. This burden has in some cases interfered with their prime function of teaching, and has resulted in a separation of the university work from the governmental work. The Lincoln Laboratory of MIT and the governmental work done by Stanford University are examples of such separations of function. These laboratories, although contract operations, if set up on a permanent basis and merged with the military research and development laboratories, could become the "inhouse" effort capable of providing the guidance needed by the entire research and development program of the military.

J. W. MARCHETTI.

Mr. RIEHLMAN. Are there any other questions from the members of the committee or from counsel?

Mr. BALWAN. I want to say that Mr. Marchetti has helped the staff and there has been no hard feeling on the part of Mr. Marchetti against the research center. He does not have a job, but he feels that he can probably get a much better job in industry.

Mr. MARCHETTI. That is what I plan to do.

Mr. RIEHLMAN. I want to express to you our appreciation for coming down here and giving this important information.

Mr. MARCHETTI. I hope it will be of some use. I am sure that the folks in the laboratory can stand a litle help.

Mr. RIEHLMAN. We are sure you have a very sincere interest in this research and development program because of what it means to the defense of this country, and we certainly share that feeling with you, sir.

Mr. MARCHETTI. Thank you.

Mr. RIEHLMAN. Thank you for coming down.

We will recess at this time until 10 o'clock tomorrow morning.

(Whereupon, at 5:46 p. m., the subcommittee recessed to 10 a. m., Friday, June 11, 1954.)

ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

FRIDAY, JUNE 11, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON MILITARY OPERATIONS OF THE
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met at 10 a. m. in room G–53, United States Capitol, Hon. R. Walter Riehlman (chairman of the subcommittee) presiding.

Mr. RIEHLMAN. The subcommittee will come to order.

We would like to have you sworn, Doctor. Will you raise your right hand.

Do you solemnly swear the evidence given before this committee will be the truth, the whole truth, and nothing but the truth, so help you God?

TESTIMONY OF DR. EDWIN G. SCHNEIDER, TECHNICAL MANAGER, MISSILES SYSTEMS LABORATORY, SYLVANIA ELECTRIC PRODUCTS, INC.

Dr. SCHNEIDER. I do, Mr. Chairman.

Mr. RIEHLMAN. Dr. Schneider, it is our understanding that for some time you filled a very important position up at the research center at Cambridge, Mass.

Dr. SCHNEIDER. I was the director of the electronics research directorate.

Mr. RIEHLMAN. You left there some time ago to take another position?

Dr. SCHNEIDER. I left there about the middle of April.

Mr. RIEHLMAN. This committee has instituted a study of this whole research and development program within the Defense Department, and we are vitally interested in all phases of it; and particularly we are alarmed and very much interested as to why so many of our civilian scientists, or many of them, are leaving the service.

Our main interest this morning is to get first of all from you, if possible, your background and your experience and the years that you were in the Department of Defense in this program, and the main reason for your leaving and going to another field of activity.

Dr. SCHNEIDER. If I understand correctly, Mr. Chairman, you would like a very brief summary of my complete background?

Mr. RIEHLMAN. That is right; if we could, first.

Dr. SCHNEIDER. I graduated in physics at Wesleyan University in 1929. I took Ph. D. physics at Harvard University and graduated

NOTE.—Asterisks denote classified material deleted.

from that in 1934. Starting about 2 years before I finished my Ph. D. I was a research assistant in the physics department.

Mr. BALWAN. Where?

Dr. SCHNEIDER. At Harvard. That was concurrent with my doctor of philosophy work.

I stayed at Harvard as a research assistant, and for my last year as a part-time instructor, until 1937, in January.

At that time I went with Farnsworth Television Corp., working in their television tube department. I worked there for about 6 months. They had financial difficulties, and I moved over to Philco Radio.

I continued work in the tube department at Philco Radio, and the television department, until the summer of 1938, at which time I took a teaching position at Stevens Institute of Technology, in the physics department.

I taught there until the fall of 1941, when I went on leave of absence with the radiation laboratory at MIT. I was connected with the design of one of the Navy aircraft control equipments called the SM, and an adaptation for the Army called the SCR615.

Mr. BALWAN. What is this; a battleship or a plane?

Dr. SCHNEIDER. These are radars. The whole work in the radiation laboratory was radar.

I then headed the group that was working on aircraft control and warning equipment, ground type of equipment. That is for the Signal Corps and also for the Air Force. At that time their procurement was through the Signal Corps.

I was in charge of the group that designed the ANCPS–1 equipment, which saw service in Europe. We actually "crash built" six equipments which got into combat.

Mr. BALWAN. What was this?

Dr. SCHNEIDER. This was a very long range equipment, which was originally designed for early warning but saw its main usage in controlling our fighter aircraft over enemy territory.

Mr. BALWAN. What part did you play in this design?

Dr. SCHNEIDER. I was the project engineer on the design. I had a group of about 10 people. We were working directly on the equipment, and we had a great deal of support from other sections of the laboratory that were working on special components, such as receivers and transmitters.

I had the responsibility of the overall system design.

Mr. BALWAN. Is that equipment still in use?

Dr. SCHNEIDER. That equipment is not now still in use, to my knowledge, by the armed services, but one of them is operating out at the National Airport, and providing aircraft surveillance for CAA.

I understand there are two of them, the original ones, that are now giving coverage for the London air traffic. That equipment has been superseded by other equipment.

The group expanded somewhat and I had a little less connection with the design, but was in charge of the expanded group, a part of which designed and built the ANCPS–6, which is one of the sets now in use by the Air Defense Command. It is the defensive warning and fighter control radar.

We also built a small portable height finder called the ANTPS–10. That, I understand, was used in Korea. It was used in conjunction with a search radar set to get 3-dimensional information on aircraft positions.

From about March of 1944 until August of 1945 I went to England to head up the ground branch of a branch that the Radar Laboratory established in order to assist the armed services in getting some of the newer equipment into the field. It was over there that we adapted the ANCPS–1 for the fighter control, and equipped the Eighth Air Force and various sections of the Ninth Air Force and Twelfth Air Force with equipments which were taken into combat.

Mr. BALWAN. Was this in preparation for D-day?

Dr. SCHNEIDER. It was in preparation for D-day, and some of the people stayed over there longer than I did and followed the equipments over on the continent. The same group over there adapted——

Mr. MCCORMACK. How many did you have under you over in England?

Dr. SCHNEIDER. There were about 15 or 20 people.

Mr. RIEHLMAN. They were all scientists, I presume, or engineers?

Dr. SCHNEIDER. Yes, although we did have intermittently fairly large groups of service personnel who came in to get familiar with the equipment and help us truck-mount, or carry out some modification such as that. They were in general the people who were going to take the equipment into combat. We had a semitraining course during revision of the equipment; they operated as a part of the team.

We also adapted the fire-control equipment, SCR–584, for accurate control of aircraft over targets on the ground. It was used for some blind bombing applications; primarily for taking fighter bombers which had no really good navigational equipment over targets. It was particularly valuable under poor weather conditions when the fighters could be brought down through overcast and close to their targets.

Then I came back in August.

There is one other experience I had over there. The buzz bombs started coming in just after the invasion, and I served on a joint committee headed by Sir Robert Watson-Watt, to try to find out what type of equipments were needed for the defense against the buzz bombs.

Mr. MCCORMACK. Against what?

Dr. SCHNEIDER. The buzz bombs, the V–1's.

I primarily was working with the control of fighters against the buzz bombs. We took another ANCPS–1 equipment which had been down near Plymouth and moved it south of London and set it up to counter the V–1's.

I came back from England in August of 1944.

Mr. MCCORMACK. You say you served on the committee with Sir Robert——

Dr. SCHNEIDER. Watson-Watt.

Mr. MCCORMACK. How many others were on the committee?

Dr. SCHNEIDER. Oh, there were about 30 people representing the American and British fighter commands, and also the anti-aircraft experts, barrage balloon experts, and the aircraft warning and control persons.

Mr. BALWAN. Were you the only American scientist?

Dr. SCHNEIDER. No, there were 2 or 3 other American scientists. We had 1 or 2 who were primarily anti-aircraft fire control personnel. It was a mixture of civilian and military; probably over half of them military.

Mr. McCormack. Now, you got back to the United States?

Dr. Schneider. I came back to the United States, and for a period of time was working half time in the Radiation Laboratory and half time in the Office of the Secretary of War as expert consultant on the warning and control type of radar.

Then in May of 1945 I went to the Pacific and was attached to General Kenney's headquarters, Far East Air Force, and assisted them in planning their radar equipment for the invasion of Japan. My prime purpose was to provide them with information as to how the radars had been used offensively in the European theater, and also to help them in the introduction of some of the newer types of equipment.

At the time I arrived they were still using the types of equipment with which we had entered the war, primarily the SCR–270 and the SCR–268 gun-laying equipment, although they had just started to get some of the new equipment. They had bottom priority at the time the European war was active.

I was there primarily in an advisory capacity as a civilian. We fortunately did not have to use the radar we had planned.

Mr. Riehlman. You went from there to where?

Dr. Schneider. At the end of the war—well, there was one other experience I had while I was still in the Pacific. I went into Japan immediately after the surrender with an intelligence mission headed by Dr. Compton, to try to ascertain what progress the Japs had made in the technical field. I was particularly concerned with the electronics field.

Then after having been there about a month I returned to the United States and went back to the Stevens Institute, having been on leave of absence during this wartime period.

At that time I came back the Air Force had asked me to head up what became eventually the Cambridge Research Center, but on looking over the situation I decided against it, because it looked as though the circumstances under which one would have to undertake the job would not be conducive to establishing a good laboratory.

Mr. McCormack. What were the conditions?

Dr. Schneider. They were setting up a field station with remote control from Red Bank, N. J., where the Watson Laboratories were established.

I understand from Mr. Marchetti that at one point they even had to send $25 items down to Red Bank for approval. They had expenditure authority only up to $25.

It looked at the time, when I considered the job, as though whoever took it was going to have his hands pretty heavily tied. It apparently worked out that way for some period afterwards. Mr. Marchetti could give you much more detail of that period. I only have the information through hearsay.

It did not look as though——

Mr. Balwan. What year is this you are talking about now?

Dr. Schneider. That was in 1945, in the fall, about September.

Mr. Balwan. How long did you stay at the Stevens Institute?

Dr. Schneider. I went back in the fall of 1945; in November, to be exact. I stayed there through the school year, or the spring of 1947. I left in June of 1947 and went to MIT to head up a guided-missiles project which was under Bureau of Ordnance sponsorship called Project Meteor.

I stayed with that project until I went with the Air Force Cambridge Research Center in September of 1951. At that time it looked to me as though with the reorganization of the Air Force research and development program and the establishment of the Air Research and Development Command that they were approaching a setup under which they might possibly have the strongest of the three services.

Mr. McCormack. Under which they might what?

Dr. Schneider. Might have the strongest research and development program of the three services. It looked to me as though having one group coordinate the whole of research and development might be a stronger setup than the Navy and Army systems in which they have various bureaus or various departments, each carrying on their own programs without really a common tie together.

Mr. Balwan. Did they come to you and ask you if you would take a position with them?

Dr. Schneider. Yes, they did. The ones who were most active were Colonel Shenk and Mr. Marchetti. At the same time Wright Field Electronics Subdivision tried to get me to take the top technical position there. General Hayden was the one who contacted me.

I decided to go with the Cambridge Research Center. I suggested that they had a very good man at Wright Field, John Keto, and thought he was their best choice; and they finally put him up in the top technical position at Wright Field.

Mr. Balwan. He is still there?

Dr. Schneider. He is still there.

Mr. Balwan. Will you describe your experience at the Cambridge Research Center in terms of working conditions.

Mr. McCormack. Who was in command at the time you went there?

Dr. Schneider. At the time I went there General Phillips was in command. He actually assumed command just about the same time I reported on board in September.

He announced a policy when he first assumed the command, in a meeting in which he gathered a very large percentage of the people of the center together in the cafeteria, that he intended to place his best qualified man in each position, regardless of whether he was a civilian or military. He made a very sincere effort to make that type of choice throughout his whole term.

In a number of instances he had military personnel in positions that might have been held by civilians. One outstanding example was heading the so-called atomic warfare directorate he had Col. Jean Jack as head. We all respected him as a technical person. He had had considerable experience at Los Alamos and was by far the best man that the center had available to put in that position.

I know General Phillips made a very concerted effort to find a high-level civilian to take over that position, because he felt that even though he had a good man in Colonel Jack he could only count on having him for 2 or 3 years at most and it might be difficult to replace him with as competent a military man.

Mr. Balwan. What was the relationship between your position and that of the technical deputy? What did you understand your position to be there?

Dr. SCHNEIDER. My position was in charge of the Electronics Research Directorate. My job, as I understood it, was the internal management of the electronics program of the center.

General Phillips had made a point to me and Marchetti jointly that he was a little afraid that since Marchetti had been Director of Electronics he might have too much tendency to maintain detailed control, and indicated that he wanted Mr. Marchetti and myself to work together, so that Marchetti would handle the staff end and I would handle the management end and detailed program control.

Well, Mr. Marchetti, after seeing through a few things that he was in the best position to see to, because he had been following them, stepped out entirely from the internal problems of the directorate except for those times we asked him for assistance. His main relationship to me was in assisting me when I had problems with either other sections of the center, some of the service sections of the center, or with the Air Research and Development Command, or higher headquarters.

It was great assistance to have someone who could understand the technical portion of the problems who could represent you in dealing with other groups. This was the function which he carried out for us to a very large extent.

There was another very large area in which he was very heavily involved, and so were we; and that is the problem of getting project Lincoln established, particularly Air Force support for project Lincoln.

Mr. BALWAN. Had project Lincoln begun before you were there?

Dr. SCHNEIDER. It began at least a month or two before I arrived. It was just in the transition stage from the so-called project Charles, which was the study phase, to the hardware project Lincoln phase.

Mr. BALWAN. Did the Cambridge Research Center have anything to do with helping to set project Lincoln up?

Dr. SCHNEIDER. They did have quite a bit to do with helping to set it up.

Prior to project Lincoln there had been a committee formed, called the Air Defense Systems Engineering Committee, which was under the auspices of the Scientific Advisory Board of the Air Force. The Chairman of that Committee was Dr. George Valley, and Mr. Marchetti was one of the members of the Committee.

There came a point at which it looked as though certain items should be pushed into the hardware stage even though the whole study had not yet been completed. The Cambridge Research Center was asked to undertake certain contracts in order to get that work started, and also to undertake certain work in conjunction with some small groups at MIT.

That work preceded the decision to establish a large-scale project. At the time MIT was approached to undertake a very large-scale project in air defense, the institute—Mr. Killian, president of MIT, and Dr. Stratton, as provost—said they would be willing to undertake it provided the Air Force was willing to finance a study program so that they could satisfy themselves that the recommendations of the Air Defense Systems Engineering Committee were sound. So they had a 3- or 4-month study project in which they brought in people from all over the country on a temporary basis and supplied a fair number of their own personnel to review the air-defense problem. This project was called project Charles.

At the time it was then decided that a large hardware project would be undertaken. MIT had the problem of setting up their laboratories and hiring personnel, but the Cambridge Research Center was to supply the flight-test support, and that was a rather major effort on the part of the center, because they had not up to that time had any aircraft assigned to them. In fact, up until about that time the airbase at Bedford Airport was State owned and there was only a small Reserve unit there. So there were combined problems of taking over an airbase, getting the airbase set up as a functioning unit——

Mr. BALWAN. Could I get one thing straight, Dr. Schneider? Up to this point the Cambridge Research Center was primarily just that, a research center, without any big military organization connected with it?

Dr. SCHNEIDER. Yes; up to that point the research center had been primarily civilian. The mission had been entirely research, although under the guise of research they had done quite a bit of work I would class myself as development. They had actually built some radar equipments, but the mission was primarily research.

The concept of operation was that Cambridge would carry on research, and Rome and Wright Field would pick up the research ideas and carry them into development.

Mr. BALWAN. How large was Cambridge Research Center before Hanscom Air Force Base was added to it?

Dr. SCHNEIDER. It had a total personnel of something under 1,000. I do not remember the exact number.

The military were primarily supplying administrative and service functions. There was a commanding officer, a colonel. At some of the earlier stages commanding officers had been even lower ranking than that.

In general the heads of personnel, procurement, and those various departments were military, with an intermingling of military and civilian at lower levels.

Mr. BALWAN. After the Hanscom Air Force Base was added to the organization, what happened personnelwise?

Dr. SCHNEIDER. The total number of personnel—the last figure I knew—was just under 4,000. During the 3 years that this buildup had taken place there had been probably not over a 10-percent increase in the number of technical personnel. In other words, about 3,000 additional personnel had come in, with the technical end of the center remaining essentially a constant size. The rest of them were brought in primarily to operate the airbase.

Mr. BALWAN. How many military men were there there when this was a center without the airbase, roughly?

Dr. SCHNEIDER. I do not know exactly, but I am sure it was well under 100.

When I first arrived the various groups—at the time we got together with the party for General Phillips and so on the group was extremely small. I believe most of the officers were present. I doubt if there were more than about 50. One could find out from personnel records.

Mr. BALWAN. What was the growth in military personnel after they brought in this support function of an airbase?

Dr. SCHNEIDER. Well, I am very sorry that I do not remember the figures, but I believe the military strength is something around 50 percent. The bulk of them are associated with the flight effort.

Mr. BALWAN. Was there a noticeable change in emphasis from working in a civilian organization to a military organization as soon as this support function was brought in?

Dr. SCHNEIDER. Yes, there was quite a noticeable change. One of the first things that occurred was that the Air Inspection Service began to become extremely interested in the center, because their main mission is to watch the airbase operation. In the normal combat operation one of their main functions is to insure that each of the combat units is equivalent, as well as one can. If one has F–94 fighter squadrons it is essential that the commander know the capability of each one of them, so that they watch maintenance and operational practices and also make sure that modifications have not been made, that the organization is standard, because in a combat operation one must be prepared to have attrition and rotation. The new person being assigned must be able to take over the job and be effective the first day.

Mr. BALWAN. Did you notice that the inspectors began to take an interest in your work?

Dr. SCHNEIDER. The inspectors began to come into the laboratories and insist that we file our papers according to standard Air Force regulations. We followed various and sundry Air Force regulations in detail. They were much more interested in whether we were filing papers according to their procedure than they were in the mission.

We had almost no representation come in from outside which has shown any interest in whether we were doing a good or bad job in the technical area.

Mr. BALWAN. But they were interested——

Dr. SCHNEIDER. They were very interested in the administrative details. They were even proscribing on what dates—that is, how long we could keep certain documents, even technical documents. In some cases we had a great deal of difficulty convincing them that we needed to keep some of these documents. Even some of our procurement-information documents, for purposes of budget estimating in the future—the regulation said that after you received the material you should scrap the paper. We had a continual battle with the air inspectors to be able to keep some of this material in the files.

Mr. BALWAN. What kind of leadership did you get from ARDC, Baltimore?

Dr. SCHNEIDER. We had relatively little leadership from them. While General Phillips was there he made quite a large number of trips to Baltimore to try to get exceptions to the desires of the air inspectors on the various regulations, and was quite successful in doing so. Since General Maude has been there we have had very little interest on the part of anyone in the center to get exceptions. They have been apparently willing to accept these regulations without question.

Mr. BALWAN. Will you begin now with the advent of General Maude and describe your experiences under General Maude's administration.

Dr. SCHNEIDER. Well, I would like to say just another word or two about while General Phillips was there.

General Phillips had a very clear concept that the technical mission was the real purpose for the existence of the center. Even though

the airbase was bigger, their main function was a support function, a service function, and all the other organizations such as the personnel and supply were primarily to support the technical mission. They were the service organizations.

Within the past year most of these organizations have from my point of view and observation become more monitoring organizations than they have service organizations.

Mr. BALWAN. Which organizations are you talking about?

Dr. SCHNEIDER. The groups like Personnel and Supply and Procurement. They have been more and more setting themselves up as approval authorities.

Mr. MCCORMACK. More and more what?

Dr. SCHNEIDER. Approval authorities rather than a group to try to help solve the problem. They have taken a more or less negative attitude: "You justify why you want to do it. If you can do a good enough job of justifying it we may let you do it." That is the general attitude.

ARDC has also, I think, increased their detailed approveal of requirements more and more as time has gone on. Starting about 3 years ago they began to require more and more detailed justifications for the equipment and materiel that we needed for carrying out the work. Two years ago they started a buying-list procedure in which we had to—the first go round on the budget was for 2 years in advance. We had to write up a complete buying list of materials and equipment we expected to need 2 years hence.

Mr. BALWAN. Had you invented that equipment yet?

Dr. SCHNEIDER. We had to justify each of these items by item. It has been my contention if we had known enough in detail as to what we needed for research and development 2 years hence we should not have been doing research and development, we should have been in production.

This went down to detailed justifications of items of $25 or $50, even. Obviously, except for a few big items we could not foresee our requirements in any great exactitude that far ahead, so the usual procedure was to sit down and decide what was most likely to get by, and write up a list. It came to what our experience factor indicated was about what we would need for small supply items.

We did our best to try to accurately forecast any really large items, because of procurement lead time. We could not be sure of getting them if we could not do that.

Then the year following, when the money was appropriated, a revised list had to be made up. This went through materiel channels to Baltimore and was reviewed in detail.

The experience of the 2 years in which I saw the system operate was that the money for the support items the first year did not get released until about March, almost the third quarter of the fiscal year. This last year it got released—some of it began to be released along in January or February, so that the year was better than half over by the time the support items were released.

A lot of the items were turned down not on the basis of knowledge of the program, but on the basis of the detailed justification on the piece of paper. We were informed that was the basis on which they operated.

That was just an example of the sort of detailed monitoring ARDC has established.

In Personnel we each year, up until this last year—actually, this last year they improved the situation a bit——

Mr. BALWAN. What are you talking about for this last year?

Dr. SCHNEIDER. This is the budget exercise we went through this past fall and early spring, just prior to my leaving.

Mr. BALWAN. 1953 and 1954?

Dr. SCHNEIDER. It was the 1956 budget preparation and the 1955 budget review.

Mr. BALWAN. Which was done in 1953?

Dr. SCHNEIDER. Which was done in the fall of 1953 and early part of the calendar year of 1954.

The personnel shop in Baltimore had required our justification of manpower by man-hours. This last year they relaxed and said we only needed to justify additional manpower to what we already had; we did not need to rejustify. One of the things that annoyed us about the operation was that the manpower allocations were made by the manpower shop at Baltimore without, as far as we could find, any discussion with the people that handled the program. So, on the basis of a justification for manpower they might allocate manpower on a program that had been canceled by the technical group in Baltimore, and we might at other times be directed to proceed with a program but without required manpower.

Mr. BALWAN. Who was your counterpart in ARDC?

Dr. SCHNEIDER. Our counterpart in ARDC was Colonel Osgood, the head of electronics.

Mr. BALWAN. What kind of leadership did you get from him?

Dr. SCHNEIDER. Not very much.

Mr. BALWAN. Did you know him?

Dr. SCHNEIDER. I knew him quite well.

Mr. BALWAN. He was head of what?

Dr. SCHNEIDER. He was head—I am not sure of the exact title of the job—of either Electronics Directorate or Electronics Division.

Mr. BALWAN. What was his experience?

Dr. SCHNEIDER. In general, good. He had had about 7 years' experience at Wright Field and had had experience as a radar officer with the Ninth Air Force during the war. He was reasonably well qualified.

Mr. BALWAN. He was well qualified?

Dr. SCHNEIDER. Yes, reasonably well so.

Under him he had a block of people who were very much less experienced. He told me several times what the average experience was. Starting something about a year ago he told me at one point the average experience of the people in his shop was less than 2½ years.

Mr. BALWAN. Were they all military men in his shop?

Dr. SCHNEIDER. All except 3 or 4. And that the average R. and D. experience—again last fall, in front of a group representing all of the centers involved in electroncis, he made the statement that the average experience at that time was 3 years. In other words, they picked up another half year's experience in the shop.

Mr. BALWAN. Is Colonel Osgood still there?

Dr. SCHNEIDER. He is still there, although he is due to go to Command and Staff School this summer.

Mr. BALWAN. He will be rotated out?

Dr. SCHNEIDER. Yes. Most of the officers were very willing and trying to do the best job they could, but because they did not have the technical background on which to make decisions we found it almost impossible to get decisions. Where there were disagreements between centers about the way ARDC should carry on some program the usual procedure was to tell the centers to go back and get together and reach a compromise.

Mr. BALWAN. Did that result in any duplicating among the centers that were in electroncis, such as Wright Field and Rome and Cambridge?

Dr. SCHNEIDER. Yes; it did result in some.

I think one example that affected us the most was the aircraft warning and control system for the tactical aircraft, control of tactical aircraft both against enemy aircraft and also against ground targets, carrying out interdiction and close support.

Mr. BALWAN. Was this a project requested?

Dr. SCHNEIDER. A project set up under a requirement from USAF. The Tactical Air Command is badly in need of a better means for handling their aircraft in the combat zones.

Mr. BALWAN. Who undertook to work on the requirement?

Dr. SCHNEIDER. There was a general operational requirement sent to the centers. Rome Air Development Center was given the responsibility of coordinating that program and was asked to work with Cambridge and with Wright Field. Rome personnel came up with one technical proposal for solving the problem and Cambridge personnel came up with a different technical proposal.

Mr. BALWAN. Could you explain those very briefly?

Dr. SCHNEIDER. Yes. The Rome technical proposal was one in which they primarily used the television-type techniques to get the radar picture from one point to another.

One of the big problems at the present time is that the information on the position of aircraft is now transmitted by a man reading coordinates from a map or an oscilloscope onto a map, so that we have a verbal telling to a man who stands at a plotting board, and he takes the position as read to him over the phone and puts a marker on it.

Mr. BALWAN. That is still done now?

Dr. SCHNEIDER. That is still done. This results in very long time delays by the time you get the radar information from several radars together and this combined into an overall picture and then retold on up to a higher command echelon.

Mr. BALWAN. Mr. Riehlman, we saw that in Syracuse.

Dr. SCHNEIDER. That is still being done by the Air Defense Command and Tactical Air. If you have seen the Air Defense Command setup, the tactical setup differs in the buildings and not in the equipment.

Mr. BALWAN. What was the Cambridge proposal?

Dr. SCHNEIDER. The Cambridge proposal was one in which the process of combining this information, transmitting it remotely—in fact, even tracking of the aircraft—was practically automatic. The computations to give instruction to the aircraft you were controlling was also an automatic computation, all of this being monitored by a man.

The Rome proposal had the tracking manual, but they avoided this telling operation step-by-step by transmitting essentially television pictures.

But they did have a proposal for an automatic computation of instructions to the aircraft. In fact, our proposal and their proposal on that were really the same. We endorsed their proposal very heavily, except that we had an automatic input and so modified their computer.

Mr. BALWAN. Rome and Cambridge worked concurrently on the problem?

Dr. SCHNEIDER. We were working concurrently on the problem. At the time I was talking about, this was a study and paper proposal.

These were presented to ARDC. There was an honest question as to the relative time scale. The Rome proposal made use of quite a bit of equipment that was rather similar to what was already in existence either in private industry in television or in the wide band communication equipment that the Bell Co. has had for some of their television links; so there was some reason to believe that possibly the Rome proposal, which would gain something for Tactical Air, could be in the field earlier than the Cambridge proposal, which was a bigger departure.

On the basis of the possible difference in time scale ARDC suggested that both of them proceed for awhile, to see what the real time scale and the real capabilities were likely to be. So during this period there was relatively little conflict between the two centers. The ground rules had been fairly well defined. We were to have a demonstration in late summer or fall of this last year.

Mr. BALWAN. 1953?

Dr. SCHNEIDER. In 1953. By late summer it had become quite obvious to anybody who cared to look at the picture that the time scales were substantially the same. We had had inordinately good luck in having our first designs work, and Rome had had some difficulty with some of their plans. It was not their fault, but just the way a technical program goes. If you are fortunate on your guesses you may not have to spend so much time.

As I say, by late summer it had become quite obvious that the time scales were substantially the same, and the Tactical Air Force informally expressed the opinion that they preferred the mechanized equipment.

Mr. BALWAN. Which was developed?

Dr. SCHNEIDER. The Cambridge equipment, which was developed and had been demonstrated.

The ARDC, however, made no decision and let the two programs drag on until some time in very late winter, when the Tactical Air Command finally stepped in and made the decision for them.

Mr. BALWAN. Are they still working?

Dr. SCHNEIDER. There was a period of about 6 months' duplication. I think it was attributable primarily to the fact that ARDC did not have enough confidence in their technical judgment to make a decision.

Mr. BALWAN. Are they still working concurrently on this project, or has it been resolved?

Dr. SCHNEIDER. No, there are certain portions of the Rome proposal everyone agreed should be done that were not a part of this particular aircraft warning control, this radar net. There were some auxiliary navigation equipments. Rome is continuing on those, but

there is complete agreement between centers, and there was from the beginning, that Rome should push those.

Mr. BALWAN. Could we proceed with your experiences under General Maude?

Dr. SCHNEIDER. Well, under General Maude——

Mr. MCCORMACK. Suppose you get General Phillips first.

Mr. BALWAN. I am sorry. Did you have some more?

Dr. SCHNEIDER. I believe I made the remark that I primarily—I meant to say that General Phillips had clearly recognized the service nature of a lot of the other portions of the center and had kept them operating effectively as service functions. He did not believe in strong center control over the technical program. He relied on his three technical directors as his prime advisory committee and prime group to reach decisions affecting the technical program.

Under General Maude more and more the control of the resources has been passed into the plans and operations section, which he has built up considerably more than it was under General Phillips; staffed largely by officers, most of whom have had relatively little research and development experience. This group is getting more and more in a controlling position by controlling the budget and controlling the allocation of resources.

Mr. BALWAN. Does this have a bad effect on research?

Dr. SCHNEIDER. Yes, it does, because your real control is through your money and your resources. You could quite easily kill a program or stop a program by the control of the resources. You may not completely control the direction in which it moves, but you can certainly control the rate.

Under General Phillips whenever there were many resources that were not primarily for one directorate, when he had the job of dividing on a centerwide basis, he always got the directors together to discuss the allocation and what the implication would be on the program, and the final decision as to where this additional number of personnel spaces or additional funds might be placed was essentially a combined decision of General Phillips and the directors in charge of his technical program.

Mr. MCCORMACK. In other words, real teamwork?

Dr. SCHNEIDER. Real teamwork.

Within the last few months under General Maude we have merely received a notice from the Plans and Operations that such-and-such a division had been made of a few additional personnel spaces; or a cut would be distributed so-and-so.

M. BALWAN. Were you consulted very much?

Dr. SCHNEIDER. Not consulted at all. The only consultation we had in those cases was after the fact, when we squawked.

He also made a lot of changes in organization that we felt affected the operating directorates without discussion with us. General Phillips, again, had always been very careful to discuss any organizational change with the particular people that were to be affected by the organizational change. Obviously, if he wanted to make some change in the airbase, unless it could possibly affect the technical program, we had no part of that and had no interest in it. If any change was to be made that might affect us he always called us in.

General Maude has in general operated by announcing the changes.

Mr. RIEHLMAN. Do you have any idea where General Maude was getting his information and coming to the conclusion that he wanted to make these changes? On what basis were these made; do you know?

Dr. SCHNEIDER. Mr. Chairman, I do not know. I have never been able to find out. I do not know. Some of it may have been personal observation, but he began to make changes so soon after he arrived that if they were based on personal observation they certainly were not based on any detailed study.

Mr. RIEHLMAN. From your own knowledge of his operation—you probably have some knowledge of his background and experience—do you feel he was in a position to evaluate as quickly as that the needed changes?

Dr. SCHNEIDER. No, sir; I do not. The first major change in organization he announced was in June or July. He had come about the 1st of May.

Mr. MCCORMACK. Of last year?

Dr. SCHNEIDER. Of last year. This was a change in which he moved Mr. Marchetti from the chain of command to an advisory position; Mr. Marchetti's office.

Mr. MCCORMACK. Was that not later than June or July?

Dr. SCHNEIDER. That was when this—in June or July. I think it was approximately July 1. Whether it was the tail end of June or the early part of July, he brought out a new organization chart in which the Office of the Technical Deputy, as it was called at that time, was moved from the chain of command and put in a block at the side.

Mr. BALWAN. As a technical assistant; is that not right?

Dr. SCHNEIDER. Yes.

Mr. RIEHLMAN. That is right; as the technical assistant.

Dr. SCHNEIDER. There had been no discussion with me or with Dr. Landsburgh or Mr. Marchetti prior to that.

We objected to this change in organization, and General Maude then retracted that organization chart and put Mr. Marchetti back in the block where he had been before; but in actual fact used him as though he were off at the side in a purely advisory capacity.

Mr. MCCORMACK. Why did you object, for the record?

Dr. SCHNEIDER. We felt very strongly that in our dealings with ARDC and with some of the other center personnel or center sections that we should have someone who represented us at the command level.

Mr. BALWAN. By "we" you mean——

Dr. SCHNEIDER. The Directors. We felt that the person who should represent us on the staff level or command level should be someone who had a good technical background so that he would understand our problems.

Mr. MCCORMACK. What is your opinion about Mr. Marchetti's ability to serve in that particular position?

Dr. SCHNEIDER. I can only speak from the point of view of what he did for my directorate, which was in his field of specialty. I was very pleased with the help we got from him.

Mr. MCCORMACK. Of course, there were two other directorates; were there not?

Dr. SCHNEIDER. Yes.

Mr. MCCORMACK. He was an electronics man?

Dr. SCHNEIDER. He was primarily electronics. I am not in a good position to know how well he succeeded in representing the geophysics and atomic warfare.

Mr. MCCORMACK. Are there many men who are specialists in the three fields?

Dr. SCHNEIDER. I do not believe that you need a person who has a high degree of speciality in the field. I think you need a person who is sufficiently technically trained that he can understand and in general grasp the major aspect of the problem.

Mr. MCCORMACK. And who has a supervisory mind and is capable?

Dr. SCHNEIDER. I do not feel that that position should be really so much supervisory; as a representation or representative position.

Mr. MCCORMACK. But the supervisory ability and experience would be important?

Dr. SCHNEIDER. He should have some supervisory ability and experience.

Mr. MCCORMACK. He is the one who confers with the heads of the 3 departments, the 3 directors?

Dr. SCHNEIDER. Yes.

Mr. MCCORMACK. He is sort of a consultant or adviser to the commander?

Dr. SCHNEIDER. Yes.

Mr. MCCORMACK. He is a liaison man. He makes decisions?

Dr. SCHNEIDER. That is correct.

Mr. MCCORMACK. There are many excellent men in every walk of life, outstanding men, who are very valuable but who are lacking in a decisive mind.

Dr. SCHNEIDER. That is correct.

Mr. MCCORMACK. Did Mr. Marchetti have a mind of decision?

Dr. SCHNEIDER. In my contact with him I would say he definitely did.

Mr. MCCORMACK. Some place along the line somebody has to make a decision.

Dr. SCHNEIDER. Yes.

Mr. MCCORMACK. In any walk of human activity.

Dr. SCHNEIDER. In all of my experience with him he was a person from whom you could get decisions.

Mr. MCCORMACK. I just wondered about your opinion. You have given your background and education and experience. I would say, if I were sitting as a judge, you qualified certainly in the electronics field as an expert witness, if I were hearing testimony.

Dr. SCHNEIDER. Thank you, sir.

Mr. MCCORMACK. The probabilities are that both counsel would agree that you are qualified, without your stating your qualifications; but on what you have said I would say there is no question but what you have qualified as an expert. The value of the testimony is another thing, but I am speaking of your qualifications. I know you have had years of actual experience.

All you can do is give your opinion, but that is opinion supported by your own knowledge.

Dr. SCHNEIDER. Surely.

Mr. MCCORMACK. Your own experience, your own position in your profession, and your own observation, and your contacts with Mr. Marchetti and with others in similar positions during the past years.

What is your opinion as to the qualifications of Mr. Marchetti to fill the position he was filling as technical deputy or technical director, whichever the title is?

Dr. SCHNEIDER. I think his qualifications were reasonably good. I am not at all sure. You may have been able to find a somewhat better man.

Mr. MCCORMACK. I am not asking about finding somebody better. You probably could find somebody better to represent my district, but I happen to be here.

Having Mr. Marchetti in mind, would you say he was a qualified man for the position?

Dr. SCHNEIDER. Yes, I definitely would.

Mr. RIEHLMAN. Any other questions?

Mr. MCCORMACK. Pardon me. You were then going to pick up.

Mr. RIEHLMAN. Go right ahead.

Mr. BALWAN. Just go ahead.

Dr. SCHNEIDER. I might give you one further little amplification of the situation with regard to the standard Air Force organization.

In the standard Air Force organization they have a group called the staff. They essentially sit across the top of the chart, and then the operating personnel are below. We had no clear-cut reporting point to the staff. We had no one at the staff level, after Mr. Marchetti's office was abolished, who was really representing us in the dealings with the remainder of the staff.

Mr. BALWAN. You had a steering committee.

Dr. SCHNEIDER. Well, this steering committee cannot in general carry on the kind of functions I have in mind, where if we are having trouble with personnel or with procurement we can maybe discuss it in the steering committee, but then we go in with our old hats (i. e. as individual directors) on pretty much, if we go in to represent ourselves.

Mr. BALWAN. But you had Mr. Jones, who is secretary of the steering committee, we are told by the general, who provided the continuity from Mr. Marchetti's old job, and was also represented on the plans and operations staff.

Dr. SCHNEIDER. Mr. Jones does not have the stature to carry any appreciable weight in dealing with other bosses of the center. We had almost no help out of him.

Our main recourse after that office was abolished was going to Colonel Ingelido, the vice commander.

Mr. BALWAN. Who was a very good flier, I understand.

Dr. SCHNEIDER. He was a very good flier and has somewhat of a technical background, so that he could somewhat understand our problems.

Mr. BALWAN. I think we could wind up this testimony, Dr. Schneider, by describing the conditions which finally led to your resigning from the organization.

Dr. SCHNEIDER. Well, the conditions that finally led to my resigning were that in December General Maude announced again, without any prior discussion with any of the directors, that he was abolishing the office of what at that time was called the technical director's office. Mr. Marchetti was a very senior civil servant and was given the option of either resigning or stepping down into the director of electronics position. Although I had no civil-service tenure rights,

because I came in after the Korean war started, they did offer me a vacant position as deputy director for components and techniques.

Mr. BALWAN. He bumped you, in other words?

Dr. SCHNEIDER. He bumped me.

Mr. BALWAN. Did that mean a change in grade or salary?

Dr. SCHNEIDER. It did, but that was not very significant, because it meant going from one of the low steps in one grade into the high step in the other grade.

The reason for my resigning had much less to do with the salary change than it had to do with the change in the organization, the buildup of the plans and operations department in the center, which was more and more stepping into the technical management of the internal workings of the directorates; and it looked as though a pattern was going to develop quite similar to the pattern that has been in existence at Rome for quite some time, in which the people at Rome Air Development Center, the plans and operations, have actually provided detailed control of the technical programs.

Mr. BALWAN. By whom are you employed now?

Dr. SCHNEIDER. I am now employed by Sylvania Electric Products.

Mr. BALWAN. In what capacity?

Dr. SCHNEIDER. I am technical manager of their missiles systems' laboratory.

Mr. BALWAN. Did you have that position in mind when you left Cambridge?

Dr. SCHNEIDER. Yes; I did. The offer for the position, however, came after I had decided I was going to leave Cambridge.

Mr. BALWAN. Could you tell us to what extent the salary factor is an important one in drawing scientific personnel from Government laboratories?

Dr. SCHNEIDER. In the case of a fairly large number of people who left it has been a minor factor. In others it has been a major factor. In my case it was not.

Mr. BALWAN. Would you have stayed on if conditions had been satisfactory?

Dr. SCHNEIDER. If General Phillips had stayed on.

Mr. BALWAN. Why do scientists want to work in the Government at all?

Dr. SCHNEIDER. May I give you my own reasons? I felt so very strongly that the safety of the country required strong Government laboratories, and it looked as though possibly I could assist somewhat in building up at least one of the Air Force laboratories to the point where it could make a real contribution. It was my personal feeling that the postwar record of Wright Field and Rome, before I went to Cambridge, was nothing to be extremely proud of. Many of the equipments just now getting into the service were really on the drawing board at the end of the war.

Mr. BALWAN. Was there a lot of discontent in the electronics directorate when you left Cambridge?

Dr. SCHNEIDER. Yes, there was. There was some fair amount of internal friction in the directorate. There had been for some time. In fact, it dates back to 2 or 3 years ago at the time the center was directed to take on the air defense responsibility under the Air Defense Systems Engineering Committee. A group of laboratory chiefs who wanted to keep the research in the pure research field made a very

strenuous effort against the air defense assignment being taken on by the Cambridge Research Laboratories. The effort to prevent it from being taken on resulted in a bitter fight between that group and Mr. Marchetti. The center was directed by higher headquarters to take on the project. Mr. Marchetti felt that the laboratory owed it to the country to take it on. He felt if they could make a real contribution in air defense they definitely should do so. But a group of laboratory chiefs felt that to get development in the laboratory would possibly cut back upon the amount of research, and they were more interested in continuing research. It is my personal feeling that they had had some years with fairly green pastures with no pressure to make the research fruitful.

Mr. BALWAN. Were you instrumental in employing most of laboratory chiefs at Cambridge?

Dr. SCHNEIDER. I was not instrumental in employing any of the group of laboratory chiefs. I was instrumental in employing the man who is now heading up the systems' effort, the development effort.

Mr. BALWAN. Was there anybody in the electronic directorate who could have been promoted from within to become the director?

Dr. SCHNEIDER. Do you mean after I left?

Mr. BALWAN. After you and Mr. Marchetti left?

Dr. SCHNEIDER. I can only give you hearsay as to what happened after I left. Maybe Mr. Frick can give you more information.

Mr. BALWAN. My question is, in your opinion do you think there was anyone there who could have been promoted from within to head that up?

Dr. SCHNEIDER. There were 2 or 3 people who might have been capable of heading it up. But I think this fight between the research-minded people and the development-minded people was so strong they could not arrive at a compromise candidate. Whoever was acceptable to one side of the house was not acceptable to the other.

Mr. BALWAN. Have you heard whether the situation there has improved?

Dr. SCHNEIDER. I have talked with 2 or 3 people in the last few weeks and they have expressed to me there is a lull in the situation. They do not feel that anything has been solved.

Mr. RIEHLMAN. There has not been anything solved. If there has not been, there is not much progress in the projects that are being carried on there either, is there?

Dr. SCHNEIDER. I think you will find people at the heads of some of the laboratories have done the best they can to shield the working people under them from the fracas, and in trying to keep their work going on. I know the head of the development group has had a group continuing very actively on their jobs. Many of them have indicated to me personally they think they will leave the center when they finish the Tactical Air Command job, which they definitely feel they must see through to the point where it is in good hands and it is assured in the field.

Mr. RIEHLMAN. I would like to ask you this question: Can you give us briefly the reasons for their all wanting to get out of there?

Dr. SCHNEIDER. Well, I would say quite bluntly I would put my reasons and the reasons of a lot of other people in the statement that we have earned ourselves a position of respect in the technical field and rather expect to be treated in accordance with the rank

we have earned in the technical field in carrying out our job assignments. It is my feeling that the civilian technical personnel in general are being controlled by groups who are not nearly as well qualified as they are in the technical field. I think the military could object just as strenuously if some civilian were put in charge of their operating commands who was not a tactical or strategic expert. It has been my personal experience that the technical personnel have had nothing but the best relationships usually with the operational personnel. They respect each other as experts in different fields. The biggest friction has come in dealing with those parts of the services where the personnel are pseudotechnical, and usually are not as well qualified as the civilians are.

Mr. BALWAN. Do you respect a good tactical commander, or flier?

Dr. SCHNEIDER. I very highly respect a good tactical commander, and I also respect a really technical officer, and I have known some. I personally feel that the basic difficulty with developing technical officers in the armed services is the rotation policy. They are not allowed to remain long enough in a technical assignment, a single technical assignment, to become proficient; to have an opportunity to get full credit for having completed a job, which is the basis for credit in the technical world. Those officers who have had an opportunity to publish technical papers, or who have seen through a project and have been highly successful, are respected by the other personnel in the technical field, but no matter how good the officer, if he is pulled off the job before he has had a chance to show results, he is not in a position to gain respect of the technical persons.

Mr. BALWAN. After General Maude arrived, did you ever brief him on the projects that were under way at the center?

Dr. SCHNEIDER. Within a few days after General Maude arrived, we offered him a briefing, and he said since there was going to be a project review by Dr. Reinhardt from Penn State, that he would wait and attend that briefing. As a matter of fact, he only attended half the briefing.

Mr. BALWAN. When was that?

Dr. SCHNEIDER. In June, a year ago.

Mr. BALWAN. He attended half a meeting?

Dr. SCHNEIDER. He attended half of it. The other half, we were told, he was on leave.

Mr. BALWAN. And how about subsequent to that?

Dr. SCHNEIDER. Subsequent to that he had never requested a briefing. We have never given him a complete briefing, nor have we given any group a briefing when he was present.

Mr. BALWAN. How about his officers and his staff?

Dr. SCHNEIDER. There would not be more than 2 or 3 officers who have ever attended a briefing. Colonel Ingelido, the vice commander, has attended 2 or 3 briefings. I believe Colonel Adams, the head of plans, has been better briefed than most of the other officers.

Mr. MCCORMACK. What kind of a man is General Phillips? How do the technical men like yourself view General Phillips from the angle of his technical knowledge?

Dr. SCHNEIDER. General Phillips had a reasonably good technical knowledge, but the one thing that made us all respect him was he knew how much he knew. He knew his limitations and he sought advice in areas in which he did not feel qualified.

Mr. McCormack. He knew how to handle men, military and civilian?

Dr. Schneider. Yes. He knew how to handle men. He realized the importance of making a decision even though there was a risk he might be wrong. He would give a decision in order to get ahead with the job.

Mr. McCormack. Did he ever bypass you in anyway?

Dr. Schneider. He never bypassed me.

Mr. McCormack. Have you been bypassed under the present commander?

Dr. Schneider. Yes; we have. We had a great deal of direct communication between General Maude and the laboratory chiefs, and I was not aware usually that he had conversations with them.

Mr. McCormack. What effect does that have on your ability to perform your duties? I mean not only from the angle of your duties, but from your professional standing?

Dr. Schneider. In performing my duties, it several times placed me in the embarrassing position of having decisions made by the front office that I did not know had been made—decisions made by General Maude.

Mr. McCormack. And with consultation with those under you?

Dr. Schneider. With consultation with those under me. I had no opportunity to express myself. I did not always agree with the decisions that had been made. In other cases, it prevented or hindered me from getting some of these people to follow procedures. I had a great deal of difficulty with the same personnel in dealing with other parts of the center, and not furnishing full information, so we would then get a call back from Procurement, for example, trying to find out what the story was on the incomplete request they had had, and we would start then and try to find out who had originated it.

Mr. McCormack. All producing a feeling in your mind that there was a lack of confidence in you?

Dr. Schneider. I took it that way, sir.

Mr. McCormack. Having been a leader myself in the House and now in my second position in the Democratic Party, I see how I would feel if I were bypassed; at least, I would like to be consulted. I can see if I were consulted I could save face, so I am asking these questions and applying my own experience from my own life to date.

Mr. Riehlman. Would you at this point, Mr. McCormack, not say that it would be absolutely true in industry or any other field of activity?

Dr. Schneider. That is right.

Mr. Riehlman. Where you had a man in a supervisory position, a man who was at the top of an organization, and the president was depending upon him to get certain information and pass it on to him, and the president was accepting all the information from the lower echelon and was acting in accordance with their directives, or discussions and bypassing the man who was up on the top echelon, supposed to be supervising, it would certainly disrupt the whole organization and do away with harmony.

Mr. Schneider. That is precisely what happened. It is my feeling if General Maude was dissatisfied with my performance he should have come to me and expressed so directly rather than dealing with people under me.

Mr. McCORMACK. Of course, there has to be this association of the military and the scientists.

Dr. SCHNEIDER. Sure.

Mr. McCORMACK. The problem confronting not only this subcommittee but everyone else is how can we have a working-partnership relationship so that we can get the maximum for our country. The military have to be in there. I realize that there are some scientists who believe in a strict civilian setup. I am not arguing against that, but I am viewing it practically as we sit here today.

I might say that we asked the same question of Mr. Marchetti.

Dr. SCHNEIDER. Surely.

Mr. McCORMACK. And he suggested very wisely it is a question that requires thought. He believe in a strict civilian setup to the point of production, or engineering. Without passing upon that, my opinion at this time would be that improvement in that direction would be difficult to obtain.

Dr. SCHNEIDER. Yes.

Mr. McCORMACK. That is my personal opinion. I may have views that might agree with Mr. Marchetti; I am not saying I have, but I again have to be practical. I would like to ask you, Mr. Chairman, that we permit the doctor to state his views as to how he thinks this partnership between the military, which is the discipline group—they have to be—and the scientists, which are probably as undisciplined as any group of human beings can be, should be set up.

Dr. SCHNEIDER. Surely.

Mr. McCORMACK. The very nature of their studies, their life, their history, and so forth, produce that result; so what do you think can best be done so that partnership can be established where we can get the maximum results, recognizing there has to be an officer in command. We have to face that fact. But how can these two necessary forces operate? How can they operate with the minimum friction and with the maximum of results? There are no such things as complete results; we are human, but how can we obtain maximum results in the setup?

Mr. RIEHLMAN. If I interpret your question and request correctly, we give the doctor an opportunity to think this through and put it down on paper and send it to us?

Dr. SCHNEIDER. If you prefer it that way.

Mr. RIEHLMAN. I think we would because I think you could give us a much better answer if you had a chance to think it over than you could give us on the spur of the moment. We would like to insert it in the record at this point.

(The information requested is as follows:)

SYLVANIA ELECTRIC PRODUCTS, INC.,
Whitestone, N. Y., June 30, 1954.

Mr. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Washington, D. C.

DEAR MR. RIEHLMAN: In accordance with the request made at the hearing of the Subcommittee on Military Operations, I am submitting the following personal recommendations of steps which might be taken to improve the conduct of research and development in the Department of Defense without carrying out a drastic reorganization:

1. Provide better stability of program, policy and organization by—

(*a*) Increasing the tour of duty of officers in research and development to 5 years.

(*b*) Appointing a high-level civilian as deputy commander in charge of the research and development mission at each installation carrying out research and development programs. Possibly test installations and proving grounds should not be included in this recommendation.

The longer tour of duty, in addition to providing increased stability, should result in improved quality of technical officers since they would have an opportunity to see projects through to completion, whereas now they are usually reassigned during the course of a project.

The appointment of a civilian as deputy commander in charge of the research and development mission is recommended particularly for those installations where no officer of equal technical competence is available. In my opinion it is necessary to have a man at top staff level who is thoroughly familiar with the problems of research and development and who is recognized by the engineers and scientists under him as professionally qualified to hold the chief engineer or senior scientist position. In laboratories which are primarily staffed by civilians at the working level, a further argument favoring the selection of a civilian as deputy commander is the feeling that the civilian problems will receive more sympathetic consideration from a fellow civilian.

2. Separate the command of primarily military operations, such as air bases, from the command of research and development laboratories. It is believed that this step would enable the commanding officer to give his full attention to the research and development mission, whereas at present a number of commanders together with their staffs are forced to spend an appreciable portion of their time on routein operational problems.

3. Provide a set of rules and regulations which are specifically designed to meet the requirements of research and development. Service-wide regulations which are primarily designed to cover the problems of operating units frequently hinder the conduct of research and development. At present the negative approach of obtaining waivers based on demonstrating that the regulation is harmful to the mission is used. The net result is that waivers are obtained only when serious difficulties arise. The positive approach of preparing a special set of regulations would alleviate many areas of minor problems and would thereby improve morale.

The research and development organization of the British Admiralty may be of interest to the committee since it is intermediate between the present practices of the Department of Defense and the British Ministry of Supply which is a strictly civilian organization. There is an Office of Naval Research London report on this subject entitled "Organization of Research and Development in the Admiralty" by K. R. Eldredge dated approximately June 1952 which I understand should be obtainable through Mr. Larrick, code 402 S, Office of Naval Research, Department of the Navy.

Sincerely yours,

EDWIN G. SCHNEIDER,
Technical Manager, Missile Systems Laboratory.

Mr. RIEHLMAN. I would also like to ask permission—and I do not think there will be any objection—to insert in the record at this point the letter that was sent by the doctor to me, which includes a lot of requests in respect to our study.

(The letter referred to is as follows:)

SYLVANIA ELECTRIC PRODUCTS, INC.,
Whitestone, N. Y., June 7, 1954.

Mr. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Washington, D. C.

DEAR MR. RIEHLMAN: In response to the request contained in your letter of June 4, 1954, I am submitting the following statement regarding my views of the problems associated with the conduct of research and development within the Department of Defense and in particular within the Department of the Air Force. I am sorry that time did not permit a more careful and orderly presentation.

It is generally recognized that most of the actual research and development work should be carried out by industry and other private institutions and in this area no serious problem appears to exist. The main problem seems to be the role of the Department of Defense agencies in research and development and in particular the role of the Government laboratory.

It is my personal view that the service laboratories are needed to carry out the following functions:

1. Bridge the gap between the operating portions of the armed services and the technical personnel in private industry. By this statement, I mean that the technical personnel of the service laboratories should spend sufficient time with the operational commands to thoroughly understand their requirements and problems so that detailed questions of the contractor can be answered and also, that these same personnel should be sufficiently expert in their technical fields to advise the operating commands of probable new weapon capability.
2. Work with industry to assist in making decisions which will lead to maximum operational utility of new equipment.
3. Perform engineering testing of new equipment to see that it is suitable for military use.
4. Assist in the introduction of new equipment into the field.
5. Ascertain modifications and improvements which are needed.

If the above functions are to be carried out effectively, high caliber technical personnel are required. Therefore, it is pertinent to examine some of the characteristics of such persons in order to understand the atmosphere which must be created in order to attract and hold them. In general they have a creative urge and many are strongly motivated by a desire to achieve a reputation in technical circles. Hence it is necessary to give them an opportunity to carry out personally some technical work for which they can receive the credit. Furthermore, after they have gained a reputation, they expect to be given authority and respect commensurate with their professional rank. They are usually keenly interested in their job and are very impatient with procedures which do not contribute to the main mission.

With the above general remarks in mind, I would now like to discuss several aspects of the military research and development problems using examples primarily based on my experience with the Air Force.

1. It appears that the role of the Service Laboratory is not clearly defined. In the Navy the laboratories are primarily research and development agencies carrying out work for the Bureaus in parallel with private institutions. The contracting is handled primarily in the Bureaus with the laboratories frequently submitting proposals which are evaluated competitively with those received from industry.

On the other hand the present trend in the Air Force appears to be in the direction of making the laboratories essentially contracting agencies. In fact, a policy statement was issued about 2 years ago to the effect that no work should be done within the Air Force laboratories for which a contractor could be found.

2. The Air Force attitude of making the so-called laboratories essentially contracting offices has resulted in the loss of many competent civilians. For example, Wright Air Development Center at Dayton, Ohio, had a quite competent Airborne Antenna Section 2 or 3 years ago. Because most of these people were reassigned to other technical areas as contract monitors, the best of them resigned. Within the past few months the Air Research and Development Command has become concerned over the lack of advanced research and development of antennas for high speed aircraft and has directed the Cambridge Research Center to establish a sizable effort in this field. Had the WADC Airborne Antenna Section been supported this rebuilding effort would have been unnecessary.

3. The military philosophy that an officer is a jack-of-all-trades is not conducive to the conduct of research and development. In the Air Force there appears to be a belief that any officer can do an effective job in any field. The net result is that officers are assigned to research and development who have had virtually no qualifying background. Colonel Osgood, the head of the Electronics Division of ARDC has stated on a number of occasions to various Air Force technical groups that the average research and development experience of the officers in his shop was less than 3 years. These men, nevertheless, control the approval of new projects and control the research and development budget. In other words the control of the Air Force program in electronics rests in the hands of a group whose technical experience has been so limited by the variety of their assignments that they would have difficulty under civil service in qualifying for grades above GS–11.

4. Throughout the various levels of command, officers are traditionally assigned on the basis of rank. This understandably causes a given officer to build up administrative overhead in order to increase the apparent stature of his position.

During the past year at the Cambridge Research Center several hundred man-hours were spent on organization reviews of the Electronics Research Directorate. The approximate schedule of these reviews, was as follows:

In May 1953 a committee was established to review the organization and to make recommendations for a standard centerwide pattern regardless of the mission.

In September ARDC was asked to review the Electronics Directorate organization. Two high-ranking officers and a high-level civilian from their Manpower and Organization Section spent almost a week making the review and came up with a redrawn chart but made no suggestions of functional changes.

In October the local Manpower and Organization Section conducted another review.

In November or December a team appointed from various parts of the center made still another review.

It is interesting to note that not one of these groups inquired about the effectiveness of the technical output under the existing organization. Perhaps the fact that none of the personnel on these various teams had ever asked for or attended a briefing on the program is an indication of the secondary importance of the mission within ARDC.

5. Within the Air Research and Development Command, the Research and Development mission appears to be of minor importance. An ARDC monthly report, the exact title of which I do not remember, listed key personnel of all centers. It was interesting to note that in about half of the centers the man in charge of the mission was not considered a key person. On the other hand, all centers always listed the air surgeon, the adjutant, the air inspector, etc. In only 2 or 3 centers were any civilians considered as key personnel.

6. High-caliber technical personnel, civilian, or military, cannot be expected to remain in an atmosphere which places unnecessary handicaps in the solving of technical problems. The present procedures within ARDC have essentially placed the control of the program within those portions of the organization which should be of a service nature. The allocation of resources, i. e., manpower, equipment, and facilities are handled by groups who are not familiar with the program. Probably the most glaring example is in the equipment field where detailed buying lists, including items worth only a few dollars, must be prepared by the technical personnel. Each item must be justified in detail and a review is made of each item by Headquarters, ARDC, through materiel channels. The centers have been told that approval is given only on the strength of the justification sheet presented for the item. In other words, the review is not made by personnel familiar with the program and furthermore this process of detailed monitoring is so time-consuming that experience has shown that release of these items for purchase cannot be expected until the second half of the fiscal year. The net result is that a several hundred-thousand-dollar program may be delayed for want of a few small items of material.

7. The application of USAF regulations hampers the research and development program, because these regulations are inherently military in nature. The bulk of the Air Force regulations are written to cover the problems of the operating commands and combat portions of the Air Force. However, these regulations are applied throughout the Air Force wide and enforced by the air inspectors.

This obviously is detrimental in specialized areas. For example, complete standardization in filing is valuable in a fighter squadron because of personnel turnover. On the other hand, the same rules may actually force removal of important working papers from a laboratory, where they are constantly needed.

8. In most cases it appears that flight-test support should be provided by a separate organization. The operation of an airbase is a very sizable enterprise which tends to dwarf the technical mission if placed under a single command. This situation is particularly true where the base is managed by the Air Research and Development Command but supplies services to other Air Force organizations which may base as many or more planes on the field as are there for flight-test purposes. Prior to the acquisition of the Laurence G. Hanscom Field, the Air Force Cambridge Research Center totaled about 1,000 people. The total strength is at present almost 4,000. Almost the entire increase in personnel is attributable to the airbase operation and as might be expected, a very large portion of the effort of the center headquarters must be devoted to operating the base. A secondary consequence of the acquisition of the field has been the perfectly natural tendency to adapt the organization and procedures to fit the majority of the operating problems, namely, those of the base, rather than the research and development organization which has the primary mission.

9. Probably the greatest single fault of the present military policy in research and development is the rotation policy. Rotation of top officers leads to a

continual state of turmoil. Cambridge Research Center has had 12 commanding officers in 9 years. Each man had the complete freedom to make such organizational changes as he saw fit. In fact, this committee is well aware of the present situation at Cambridge.

A second difficulty with the rotation policy is that no officer is left in a technical position long enough to become a real technical expert. There is no reason why high-caliber technical officers cannot be developed but it would require major changes in the military philosophy of organization and policies of promotion.

It is my personal belief that this country would have a much stronger defense research and development program if a system similar to that now used by the AEC or the British armed services were in effect. By this I mean a completely civilian-controlled organization with heavy military representation within the laboratories as customer representatives and not as operating officials. Under these conditions there would be mutual respect between the technical and operational personnel because each would be contributing in his field of expertness.

Whether the laboratories should be Government operated or contractor operated is a difficult question to answer. It is probable that a mixed pattern might ultimately prove desirable provided the Government laboratories could operate under the same rules which are now permitted for contractors, i. e., post audit rather than detailed preapproval of small items, freedom to use local purchase when it seems desirable, budgeting for small support items on an experience factor rather than through detailed item listing and lump-sum allocations for a project with freedom to apportion the funds to best meet the project needs.

Very truly yours,

EDWIN G. SCHNEIDER,
Technical Manager, Missile Systems Laboratory.

Mr. RIEHLMAN. Doctor, we appreciate very much your coming up and giving us this information.

We will now hear from Dr. Frick. We have been taking testimony under oath, so if you will stand and raise your right hand, I will swear you in.

(Whereupon, the witness was duly sworn.)

TESTIMONY OF DR. FREDERICK C. FRICK, ACTING DIRECTOR, ELECTRONICS RESEARCH DIRECTORATE, AIR FORCE, CAMBRIDGE RESEARCH CENTER

Dr. FRICK. Yes.

Mr. RIEHLMAN. Doctor, our committee has been interested in the research and development program and in our study in this field we have been following some of the activities of the research center at Cambridge, Mass., and it is my understanding that you are now the acting head in the Electronics Research Division.

Dr. FRICK. That is right.

Mr. RIEHLMAN. The subcommittee is anxious to know something about your background and experience and the experience you are having in the operation of that field of activity there at the research center. I think that our counsel and director of the committee has discussed this matter with you before. I wonder if at this time, unless the counsel wants to take over, you will give us briefly your background and experience, and then tell us when you went to Cambridge and what your experience has been since you have been there.

Dr. FRICK. I received an A. B. degree in psychology from DePauw University, Greencastle, Ind., in 1938. Following that, I went to Cambridge University, Cambridge, England, for a year, where I studied mathematical logic primarily. At that time my educational career at Cambridge was interrupted by the war. I returned to this

country at the outbreak of the war and was doing graduate work at Columbia University, New York City.

In 1941, immediately following the Pearl Harbor incident, I accepted a job in Washington with what was at that time the Coordinator of Information, Colonel Donovan's outfit, and in February 1942 I went overseas with the COI assigned to their London office. I was overseas in the London office for a brief period attached to the Psychological Warfare Branch and then I went to North Africa as the assistant to the head of the Psychological Warfare Branch.

I returned to London, where I served in a liaison capacity with the Ministry of Information and various other English agencies interested in psychological warfare.

I was drafted when I was in England. I cannot give you the exact date offhand. I returned to this country and ended up in the Air Force. I went through radio school in the Air Force and was an instructor in the radio school for a brief period at which time I was called out and sent overseas to Saipan, Okinawa, and the Pacific area, and I ended up writing part of the history of the Seventh Air Force.

I returned to Columbia as a lecturer in the university. I finished up my doctor's degree in experimental psychology at Columbia.

Following this I received an appointment as an instructor in psychology at Harvard University. That was in 1947. At that time I was doing research work primarily and I became interested in the mathematical theory of communications—I was interested in speech, language, and the general problem of communication.

I was at Harvard for 3 years and then accepted a job with the Air Force in Washington with the Human Resources Research Laboratories. I was brought down there to set up a division on communications research and established a research program in communications. This program later expanded to include what was to be called—a term I do not like—human engineering.

This work involved working with design engineers, electronic engineers, and systems engineers, with the aim of trying to simplify displays, controls, and so on, of the very complex equipment that is involved in air operations with the aim of cutting down on training time, and with the aim of making it possible to get more out of the equipment considering the personnel problems that are also involved.

In connection with this work I spent some time at Cambridge Research Center. For the most part I was working with their people on the development of a tactical air control system and was involved with CRC engineers in the design of visual displays of the air situation for controllers and force commanders.

In April of this year it was decided that the laboratory for which I worked at Bolling Field, and which now by this time had been assigned to the Cambridge Research Center—should set up a permanent unit to work with the CRC engineers to get a little closer liaison.

Mr. BALWAN. Dr. Frick, was the organization at Bolling Field where you were employed called the Human Factors Research Center?

Dr. FRICK. It is now called the Operational Applications Laboratory.

Mr. BALWAN. What was it prior to that time?

Dr. FRICK. May I start this from the beginning? When I first came down it was the Human Resources Research Laboratory. It

actually reported to the human factors staff, Deputy for Research and Development, USAF.

Mr. BALWAN. Headquarters?

Dr. FRICK. Headquarters; right. With the development or the establishments of the Air Research and Development Command, this unit was assigned to the Air Research and Development Command. In the course of the past 2 years the Air Research and Development Command has been tightening up its program, getting organized, and essentially setting themselves up in business, and at this stage of the game we were assigned to the Air Force Cambridge Research Center.

When we were assigned to the Air Research and Development Command, we took on a new title, Human Factors Operations Research Laboratory. At this time, I was appointed Director of the Systems Applications Directorate.

This included the Communications Research Division, which I had set up before, and it included a new division that was charged with the responsibility of performing field studies on existing systems, and design studies on systems under development.

Mr. BALWAN. Is this a military organization?

Dr. FRICK. Yes and no. It was directly responsible to the military; yes. It was not a military organization in the sense that we had only a few officers on the staff and they were not in actual positions of command. It was essentially a civilian organization.

Mr. BALWAN. Who was in charge at Bolling Field?

Dr. FRICK. Dr. Karl Kryter. He is still the director of the laboratory. In any event, it had been decided we could do our job better if we were working a little more closely with the users of our products; in other words, with the design and systems engineers, and it was decided to set up an office at the Cambridge Research Center.

I made several visits up there in the course of the past 2 years to see how this would work out and try to lay the groundwork for this unit. Actually, at the end of April I went up there to complete plans and at that time it had been decided that I personally would move up there and be followed by several other people that were working for me in Washington.

Mr. BALWAN. The idea was to bring the Washington office up there and you would continue on the work you were doing here?

Dr. FRICK. The work we had been doing actually breaks down into two parts. We were doing a certain amount of technical development, technical research, involving tests and experimentation to determine human capacities in certain lines. We were also doing a certain amount of what has been termed operations development, that is to say, we were working with people on actual systems in being in the Air Force, or systems that were under development for future operations.

Mr. BALWAN. Was this more related to the work at Cambridge than the work that was being done at Rome and Wright Field?

Dr. FRICK. We felt that it was; yes.

Mr. BALWAN. You were just about to talk about what you were doing when you got to Cambridge.

Dr. FRICK. That is right. I went up to Cambridge in April to get the details straightened out on this. At that time General Maude asked me if I would take over the job of Acting Director of the Electronics Directorate. This was following the resignations of Mr. Mar-

chetti and Dr. Schneider, both of whom I know. I said that I would. I expressed some doubt about taking on this job, which obviously was a large one. I felt probably it would be a difficult job, but I said that I was willing to undertake the responsibility and see how it would work out. I actually took on this job on the 3d of May of this year, so that I have held this position for some 6 weeks now.

Mr. BALWAN. Were there any other conditions pertaining to that job besides its largeness and its complexity which may have created some doubt in your mind as to whether you wanted it?

Dr. FRICK. Yes; to some extent. I have always regarded myself, and I like to regard myself, as being primarily a research man. My background, as you can see, is university research. This is the sort of work that I have found that I have some competence in and that I enjoy doing. This was stepping into what was essentially an executive sort of position. It obviously meant that I would not be doing research work. This was one of the chief factors that I thought about at the time, and this was the cause for some hesitancy on my part. It presented a deviation in my own professional career. I also felt that it represented a challenge, and it is difficult to turn down a challenge.

Mr. BALWAN. Do you consider yourself to be an electronics engineer, or a psychologist? How do you classify yourself?

Dr. FRICK. I considered myself to be an experimental psychologist. I have, I feel, some knowledge—certainly not a high degree of competence or expertness—of electronics, which I have essentially picked up in the course of my interest in communications, which, needless to say, does involve electronics. I have at least a speaking acquaintance with most, or a large part of the work that goes on in electronics these days. I have a large number of friends that are actively engaged in electronics work. I have some, as I say, knowledge of electronics, but I am by no means an expert and I do not regard myself as being a competent electronics man.

Mr. BALWAN. You have a lot of familiarity with that work?

Dr. FRICK. I have, I think, a considerable degree of familiarity with that work.

Mr. RIEHLMAN. To be very frank, Doctor, do you feel that a man of your background and experience is qualified to handle that type of position?

Dr. FRICK. To be equally frank, sir, I did not feel that way when I first took on the job. After 6 weeks it is a little early to form any firm impression of this. My feeling is that this is not necessarily a requirement. In other words, to be an expert in some one of the many branches of electronics would probably be helpful in this sort of job. I am not sure it is a necessity or a firm requirement. This comes as some surprise to me, but that I believe to be the case.

Mr. RIEHLMAN. And you are basing that statement on the 6 weeks of experience that you have had in that director's postion?

Dr. FRICK. That is right, sir.

Mr. RIEHLMAN. I wonder if you could just elaborate and tell us why.

Dr. FRICK. As I say, this is based upon 6 weeks' experience, but the job, as it seems to be shaping up, is essentially an executive job, which is to say we have a large number of extremely competent people. Electronics covers a large number of specialized fields, as you know.

We have a number of people, I think, who are highly qualified in most of these specialties. These people, needless to say, are consulted on any aspect of the technical program that arises where electronic competence would be desirable. I have not the ability to make the decisions on the technical details, what sort of circuits should be established to accomplish certain functions, and so on. They are made at lower levels in the directorate. As I say, I am now beginning to believe that is not impossible at all for a man with no more of a background in electronics than I have to handle this job. I do feel that a man in a job of this sort should have some feeling for, and actual experience and knowledge of research and development work. I do not think it is a critical factor whether this is knowledge of research and development is, let us say, in nuclear physics, or let us say, any of the other physical sciences other than electronics.

Mr. BALWAN. You are a scientist, and you do have an appreciation for the way scientists work?

Dr. FRICK. That is right. That, I feel is the critical feature in this job. It does require a certain amount of executive ability. I would not like to define executive ability. It certainly requires, or I feel that it requires, a real appreciation for scientists, their attitudes, the way they operate, and it requires knowledge of the way research is conducted and how it turns out the product, and the kind of product that can be expected.

Mr. RIEHLMAN. I am not an engineer or a scientist, but I am trying to evaluate the problem and job you are confronted with in trying to make decisions on very important matters that are going to be brought to your attention, as you say, from the lower echelon, where you have very many capable men. Someone has to make a decision.

Dr. FRICK. Someone has to make a decision, sir.

Mr. RIEHLMAN. I want to be very fair. I am trying to find out whether a man of your background and knowledge of this activity would be in a position to make that decision. That is the thing that I am interested in.

Dr. FRICK. Well, I think that I might add that the only reason I accepted the job in the first place is that I had received support. I gathered that my name had been suggested to General Maude by at least two of the top people at the Cambridge Research Center. One of these men is an electronics engineer.

Mr. BALWAN. Who is that?

Dr. FRICK. Mr. Milton Chaffe. He is actually the Deputy Director for Systems at the moment, and was before I came.

I feel that he is an extremely competent man.

The other man who suggested my name and stated that he felt that I could handle the job was one of the laboratory chiefs, a man named Williams Huggins. Dr. Huggins is generally credited around the Cambridge Research Center as being one of our brighter young electronics scientist—and you will notice I distinguish between scientists and engineers. My feeling was if these two men felt that I could do the job despite some hesitancy or trepidation on my part, that they were possibly in a better position to evaluate it than I and that was to a large extent the reason that I accepted the job at all.

Mr. BALWAN. Were there any other conditions about the situation at the Cambridge Research Electronics Directorate which made it more difficult than it would normally be stepping into the position?

Dr. FRICK. I had heard about the difficulties in the electronics directorate at Cambridge. There are obvious difficulties of some sort when two of your top men resign. At that time I did not know the details of these difficulties. I have made no effort to find out the details since then, as I felt it might in a sense prejudice my own judgment, and I have made an effort to stay out of these difficulties which I felt was the proper course of action.

Because of a secondhand and extremely vague knowledge of this, I anticipated that we might have some trouble; that we would have personnel difficulties of one sort or the other.

I would like to state for the record that my impressions on this have changed in these 6 weeks. I do not feel there is any particular form of dissension at Cambridge; that there are no difficulties that are not the sort of difficulties that you would expect to find in an outfit that is doing a complicated, diverse amount of work.

Mr. BALWAN. No one is planning to resign in the near future that you know of?

Dr. FRICK. Yes. Dr. Huggins, the man I mentioned, one of my best friends up there, a man who actually was the most enthusiastic about my taking over the job, is going to resign. He is going to Johns Hopkins University as professor of electrical engineering. Dr. Huggins told me about this early in the game while he was still making up his mind about it. He explained this had nothing to do with anything that was going on at Cambridge, or had gone on at Cambridge. He felt this was a position that was a little more the sort of thing he wanted to do.

I must say that I agreed with him on this, and I in a sense said that he was going with my blessing. I told him that I was extremely sorry to lose him. We are always sorry to lose good men. Dr. Huggins is a research man primarily. He is an extremely creative individual and extremely competent, and my feeling was that he might make a better contribution to the country as a university professor in a university atmosphere than he would in either industry or government.

Mr. BALWAN. I have no further questions.

Mr. MCCORMACK. Doctor, this is no reflection on you, and I do not want you to feel you are here to be interrogated other than to get information that might be of value to us.

When you leave the room, and I think I speak the sentiment of the committee, you leave with complete freedom of thought as far as anything personal to you is concerned.

You said you did not think it was a necessity or requirement that the Director of the Electronics Division be an electronics specialist. Of course, the requirement and the necessity are two different things. You realize that, of course. I can understand necessity. There was a situation up there that you probably anticipated at the center and you were offered the position and you hesitated and you accepted it as a challenge; is that correct?

Dr. FRICK. That, I believe, is what I said. I believe that states it, sir.

Mr. MCCORMACK. In other words, there was a lot of trepidation and that is not peculiar to you. We all have that in the journey of life. You did it more from the angle of necessity than anything else, I would assume from your testimony.

Dr. FRICK. I am not entirely sure that I understand you, sir.

Mr. McCormack. There was a situation up there that required somebody to be the head of.

Dr. Frick. Right.

Mr. McCormack. Apparently they did not have anyone willing to take it. Dr. Schneider had resigned.

Dr. Frick. That is right.

Mr. McCormack. Mr. Marchetti had resigned, and apparently there was no one there whom they could agree upon or who wanted to take it, either way.

Dr. Frick. I gather that what happened actually, sir, was that General Maude called in the top-level people, asked them if they had any suggestions for an interim director until such time as they might be able to appoint a permanent director.

I gather the high-level personnel there could not agree on any one of themselves, for instance, as the man to take over this job. It was felt possibly that an outsider, somebody coming in fresh, might be a good thing.

I also gathered—and I am now giving you secondhand impressions—that my name was suggested and that seemed a reasonable compromise to the people there, some of whom I knew, having worked with them, and some of whom I did not know.

Mr. McCormack. Would you recommend that policy be followed in all laboratories?

Dr. Frick. No, sir.

Mr. McCormack. Would you recommend the same policy be followed on the atomic arm and geophysics?

Dr. Frick. No, sir.

Mr. McCormack. I mean as a permanent head, a director?

Dr. Frick. General Maude has talked to me about this and as I understand it he has asked Mr. Quarles and he has asked the Scientific Advisory Board to look around to see if they can find a man of stature in electronics, a man with known executive ability, a man with research experience, and so on, that they can get in as a permanent head. I regard this job as a temporary job. I have expressed this to General Maude, and I did so when I took it over. We are essentially in agreement on this. Personally, I would like to get back into the research business.

Mr. McCormack. You have been very frank and I might say refreshingly so; not that other witnesses have not been. As a matter of fact, the whole hearing has been devoid of personalities. There has been a complete avoidance of personalities. It has been most pleasing to me to listen to the testimony of the different witnesses, no matter what side they might be on.

We are not investigating the Cambridge Center by any means. We do not want you to have any idea of that. This is simply to get information which might be a means to enable us to apply it to the broader picture of the relationship between the military and the civilians. We are talking about the technical man. You realize the importance of that.

Dr. Frick. I do, indeed.

Mr. McCormack. And the importance of as good a partnership as is possible of two groups that are really as far opposite from one another in their training and background as any two groups can be—the scientists and the military. Am I right?

Dr. FRICK. I would say not completely, sir. In general, yes; I would agree with you.

Mr. MCCORMACK. Let me particularize. I have been in the service, and when I went in I found quickly that I was a number. I may have been John McCormack, but I found quickly I had to learn the meaning and significance of two words—obedience and discipline. That is necessary in the Armed Forces. Am I right?

Dr. FRICK. That is right, sir.

Mr. MCCORMACK. And of necessity you have to live in a pretty regimented world. I use the word "regimented" advisedly. You have to obey orders.

Dr. FRICK. Yes.

Mr. MCCORMACK. And necessarily so. Your scientist is a pretty marked individualist, is he not?

Dr. FRICK. Yes.

Mr. MCCORMACK. That is what I mean.

Dr. FRICK. I would say here that I believe that the scientist is of a necessity, a rugged individualist. That is why he is a good scientist. He thinks possibly a little differently. He is creative. These people always have a certain amount of difficulty adapting themselves, or being adapted to large organizations. I do not know that the difficulties are any greater in adapting themselves, if you want, to a military organization than to an industrial organization, or any large organization. That is the only point that I want to make.

Mr. MCCORMACK. If certain factors exist?

Dr. FRICK. Yes; that is right.

Mr. MCCORMACK. A scientist—when I say a scientist I mean as a group—might recognize the necessity of a military man being in command, but not military domination. Is that right?

Dr. FRICK. That is right, sir.

Mr. MCCORMACK. And those conflicts, they do not concern individuals; they concern a group. I am not saying they exist, but stating it as a hypothetical question, if those conflicts did exist, usually it is the man at the top who produces good results, or indifferent results, or bad results. Is that your experience?

Dr. FRICK. That is my experience.

Mr. MCCORMACK. It is the spirit that produces certain results, the spirit that people think exists. You must have a pretty well balanced organization and that includes representation and the opportunity to have the views of those concerned presented. The views may not be agreed to, but they want an opportunity of representation and their views considered with some degree of equality. A military man may have to make the final decision, but the feeling there is an opportunity of presenting views is important, is it not?

Dr. FRICK. Very important.

Mr. MCCORMACK. If you have these irritations, where they think that opportunity is denied, the results could be harmful to our country, because if we are going to make progress it is in the field of basic research. Is that right?

Dr. FRICK. That is right.

Mr. MCCORMACK. The other elements that make up research and development are important, but the engineering, production, and so forth, all look to the basic research, as I understand it. Is that correct?

Dr. FRICK. That is completely correct.

Mr. MCCORMACK. And if you have too much military domination—we are just assuming now; I am not saying you say there is but assuming there is—that could be very harmful?

Dr. FRICK. I think that is true.

Mr. MCCORMACK. The trouble today is too much military domination?

Dr. FRICK. The word "domination" bothers me to this extent. We all work for somebody in some sense of the word. To the extent I, as a technical man, am consulted by, let us say General Maude, who happens to be my immediate boss and is a military man—to the extent my opinion is asked and my attitudes are taken into account, I cannot feel I am dominated.

Mr. MCCORMACK. You mean free consultation?

Dr. FRICK. Yes.

Mr. MCCORMACK. If you found out he had his mind made up before he consulted you, if he consulted you after the fact, it would be different than consulting you before the fact?

Dr. FRICK. That is right.

Mr. MCCORMACK. Or if he consulted somebody below you, consulted the Assistant Director, and then issued an order to you, how would you feel?

Dr. FRICK. I would feel very strongly.

Mr. MCCORMACK. You would resent it?

Dr. FRICK. The only point I wanted to make is that this domination, in that sense, occurs in various situations.

Mr. MCCORMACK. Leadership and domination are two different things.

Dr. FRICK. That is right. That is why I chose the word domination. Domination in this sense I would find intolerable.

Mr. MCCORMACK. Do you know whether that happened to Dr. Schneider of your own knowledge?

Dr. FRICK. I do not know of my own knowledge. It has not happened to me. I feel I have been consulted and that my opinions and attitudes are taken into account, any my feeling is if I went into private industry, let us say, I could quite possibly run into a dominance factor of the kind you are talking about and in other cases I would be consulted. It is a matter, as you brought out, of leadership versus domination.

My own experience is that I have not run into military domination, as such, in the sense in which you are speaking of it.

Mr. MCCORMACK. I am asking more in the nature of a hypothetical question. If this situation existed anywhere—I will not confine it to Cambridge Center because it might appear it is applicable to General Maude, and I am going beyond that—the bypassing of men in positions of responsibility and trust anywhere would be wrong?

Dr. FRICK. I feel it would.

Mr. MCCORMACK. And if done by the military it would certainly be marked evidence of military domination?

Dr. FRICK. It would be marked evidence of domination in a particular situation. I am sorry, this is getting extended, and I do not want to take up your time with my own opinion on this sort of thing, but the only point I would quarrel with, if I would quarrel at all, is saying this is military domination.

Mr. McCormack. Military is the man in uniform.

Dr. Frick. If he happens to be in uniform it is military domination. I do not feel there is any reason for feeling you will run into situations of domination of this sort because of military control any more than you would in private industry or than you occasionally run into in a university department where the department head would be dominant. I would not want to be on the record as saying that military control necessarily entails dominance of this sort. It has certainly not been true in my case. I know that dominance in this sense occurs outside of the military and it is not necessarily a characteristic of the military.

Mr. McCormack. What is your view as to the competence of officers being assigned to this particular field? I can apply the rules of commonsense to things you have said, and also my own experiences in my own life, and I can appreciate considerable of what you have said, and you have been very frank, and I can pretty well fit my mind into the picture you have given today. You want to get back in your own field of research. I can see you are carrying on because somebody has to do it and you were the fellow.

Dr. Frick. It was a fascinating job.

Mr. McCormack. And I admire you for that; I respect you for that. I will leave the word "admire" stand, too. If I can read your mind, you probably hope they will pick somebody else as fast as possible so that you can be relieved. Is that right?

Dr. Frick. That is right, sir.

Mr. McCormack. Take the man in a uniform working alongside a man like yourself who is giving his whole life to his profession. I have seen your background and I know you have not been idle many moments. These other men have not been idle many moments either. It conveys to me the picture of one who has an ambition to go ahead. We have all had experiences, so we can evaluate them. We may be legislators, but some of us are lawyers, like I am, or businessmen, and other fields. We started out in other fields and drifted into this probably like you drifted into the position you are in now. Take the officer in command of a place like Rome. We will leave Cambridge out for the moment. Do you think he should be a man with a good knowledge of at least one of the specialties in the field of research and have a good general experience in order to command a place like that?

Dr. Frick. Sir, I feel that he should understand and appreciate the research and development field. Probably the best way to attain such appreciation, if you are ever going to, is to actively work in the field at some stage in your career. I would hesitate to say that is an absolute necessity. I do this on the basis of experience. For example, in long conversations with Air Force officers I have run into some who have little or no active research background but who seem to be able to talk the same language I talk, who have an understanding of the problems and attitudes I take. It is not quite clear to me where they have acquired this appreciation, but I have run into a few such officers.

Mr. McCormack. A few such officers?

Dr. Frick. That is right.

Mr. McCormack. That is because they are men of good commonsense who have not lost their civilian outlook. I am not criticizing those who have; I can appreciate that. I am talking about the field of research, having in mind the national interest, developing the best

weapons we can to use if war comes—we hope we will never have to use them—and to save the lives of our people.

Dr. FRICK. That is true.

Mr. MCCORMACK. We are just human beings and we have to look at the overall situation. We realize the necessity but we cannot run an activity of this kind on the theory of necessity in the overall picture, can we?

Dr. FRICK. No, sir.

Mr. MCCORMACK. In other words, instead of asking you questions where you think I am cross-examining you—which I am not—will you give the subcommittee the benefit of your own views as to the relationship of the military to the civilian in the field of research, not confined necessarily to the Cambridge Center, and any suggestions you may have as to how the maximum results can be attained? If you want to think that over and submit it in writing, that is perfectly all right.

Dr. FRICK. I think I might rather do that if that is all right with you. That is not to avoid your question. I do have attitudes about the thing, but, as I am sure you realize, it is a complicated question. It is not a simple one to answer. I can give you a very quick, brief answer that may possibly satisfy your interests.

Mr. MCCORMACK. It is not a question of satisfying me.

Dr. FRICK. Satisfying the committee's interests.

Mr. MCCORMACK. Two other witnesses have been asked the same question and will submit their views because we realize it is a pretty broad question. In other words, it is the national interest we are all concerned with.

Dr. FRICK. I would appreciate a chance to think this over and try to get it down in writing so that it will make more sense when it comes in.

Mr. RIEHLMAN. I am sure that will be satisfactory to Mr. McCormack, and it is to me. We will insert it in the record at this point.

(The material referred to is as follows:)

The following is a written reply to a question asked by Representative McCormack of Dr. Frick before the Military Operations Subcommittee of the Committee on Government Operations.

Question: "Will you give the subcommittee the benefit of your own views as to the relationship of the military to the civilian in the field of research, not confined necessarily to the Cambridge Center, and any suggestions you may have as to how the maximum results can be attained? If you want to think that over and submit it in writing, that is perfectly all right."

Answer by Dr. Frick: The most direct answer that I can give to this question is to state that from a reasonably broad acquaintance with Government research projects and laboratories, I know of no instances where research productivity has been significantly affected by military-civilian conflicts or cooperation. This is not to say that particular programs have not been aided by military support, nor is it to say that other programs have not been hampered by lack of such support.

Project officers, laboratory chiefs, and program directors do have a profound effect on the quality and quantity of research. I have, however, observed no correlation between the research results and the military status, or lack of such, associated with the group director. In short, I do not feel that it is possible in this country to draw any very meaningful distinction between the military as a group and civilians as a group.

It is true that men who have devoted much of their lives to acquiring the special skills demanded of, say, a command pilot cannot achieve a degree of scientific competency of a man who has devoted an equivalent amount of time to the study of some scientific area. For the most part this is fully recognized and, in my experience, military people involved in research and development tend to lean heavily on civilian professionals.

This is not always an assurance of productive research or optimal research programs because the nonscientist, military or civilian, cannot always select his scientific advisers judiciously. Which leads into the second part of the question.

My opinion has been asked as to how we might achieve maximum research results in this country. I interpret this as asking how we may insure that the research capabilities of the country are best utilized. Clearly there will be as many opinions on this question as there are scientists. My own opinion is based on two assumptions: (1) Research is a highly individualized activity. Organizational schemes may decrease the individual's productivity, but they cannot insure such productivity. (2) The scientist is uniquely competent to evaluate the potentialities of other scientists. Scientists make up a very small proportion of the population and for the most part are well acquainted with each other. They are able to achieve a fairly substantial agreement as to the capabilities of individuals within their particular fields.

It follows that the best way to achieve maximum results in fundamental research is to support the activities of individual scientists. The individuals to be supported and the degree of support afforded them should be determined by other scientists in the particular areas concerned. This is, of course, the modus operandi of the National Science Foundation. Advice as to grants made out of funds available to the Foundation is received from the scientific community as represented by the National Academy of Sciences and the National Research Council.

The support of applied research, including research directed toward the needs of the military, could well follow the same pattern. In short, I feel that the basic mechanism for achieving optimal utilization of the Nation's research capabilities already exists. I do not feel that the military in particular, and the Government in general, has utilized fully the unique advisory competence available in the National Academy of Sciences and the National Research Council. As a result the funds available for the support of research are not always channeled to the most promising individuals, groups, or programs.

Mr. RIEHLMAN. Any other questions, Mr. McCormack?

Mr. MCCORMACK. No.

Mr. RIEHLMAN. Mr. Lipscomb?

Mr. LIPSCOMB. When you went to Cambridge there were a number of projects in process at that time?

Dr. FRICK. That is right.

Mr. LIPSCOMB. Has it been necessary for you to stop or change the direction of any project since you have been there the past 6 weeks?

Dr. FRICK. No, sir. The period from May through June is a period when there is essentially a lull in program changes. There has been considerable time and thought given to the organization of the program, to assessing requirements, assessing what will be needed, assigning priorities, and so on, and this ordinarily will go on in this type of organization early in the spring, to be incorporated in the budget for the next fiscal year.

Mr. LIPSCOMB. When you took the position you now occupy, what was your understanding, for example, if you thought a project had gone far enough without result, how would you go about stopping that project?

Dr. FRICK. May I give you some background on this? After I had been in several weeks, I went to General Maude and I said I understood this was an interim job and I was hoping my old job was being held open for me and that some day he would find somebody else to take my present job, and so on. Then I asked General Maude if he wanted me to carry out this job as a holding job or as a director. General Maude said he was willing to back me up and he wanted me to carry out the job as a director.

What I had in mind, as I became better acquainted with the program—I am just beginning to get acquainted with it; it will be some time before I have any real grasp of the details at all—I might very

well want to reshape things to some extent. I feel there are projects and tasks being carried on that have been carried on for some time in which the possibility of a payoff is limited. Very often in research you have to spend considerable time before you know if there will be a payoff or not. I feel there may very well be some activities there that might best be phased out. I feel there are other activities that possibly should be strengthened.

Mr. LIPSCOMB. Have you come to that conclusion from your own knowledge of electronics, or from consultation with your staff?

Dr. FRICK. I have done it very much with consultation with my staff. I felt if there was any difficulty at Cambridge it was the feeling on the part of the staff they were not consulted about things, and I have gone over backward to discuss with them every idea I have had, and I have asked them for their ideas. That takes time, but I think it is worth it.

Mr. LIPSCOMB. Have there been any administrative changes since you have been there?

Dr. FRICK. There have been none. I am at the moment in the process of trying to institute some. These are essentially minor things. The directorate staff who handle the details of the budget, requests, planning, management program, have, I felt, not had the strength they possibly should have had. In other words, the decisions tended to be made at the top. That is the feeling I have acquired in 6 weeks. I felt they should have more authority to go with the responsibilities they have. This will involve minor rewriting of job descriptions and so on.

Another problem I believe exists is that there are essentially two kinds of work that go on at Cambridge. One is a research program. This is of necessity one that extends over a long period of time. On the other side of the house we are attempting to develop specific systems and equipment for the Armed Forces. In this kind of work you have time deadlines. We are to develop a certain thing by the 15th of March, or something of that kind.

Mr. LIPSCOMB. Where does that directive come from?

Dr. FRICK. The directives are to some extent self-imposed, and to some extent they come from higher headquarters. A directive may establish a requirement for, let us say, a tactical air control system and part of the requirement is that we have this tactical air control system by a certain time.

Mr. LIPSCOMB. Is that research or development?

Dr. FRICK. That is essentially development. At Cambridge we do a certain amount of research which does not, in general, have this kind of time limitation, and we also do development work. Needless to say, where you have people working in different areas of this sort it is sometimes a little hard to mesh them together. A man who is working on development gets impatient with a man working on research, and the research man gets impatient with a development man who will not wait to see if there is perhaps a better way of doing something, which may take 1 year or 6 years.

In this research and development business you do run into those two groups. I feel that these groups should be a little more closely meshed than I think they are at the moment.

These are the sorts of goals toward which I am working. I would like to acquire a little higher degree of integration, and yesterday I

had a meeting scheduled with my laboratory chiefs and engineers where I was going to present my ideas, tell them, "Here is the problem as I see it and here is a possible solution. I would like to have your ideas." It looks like that meeting will have to be put off a week or so, but this is a gradual evolution. This is the kind of thing you are continually doing. You keep reviewing your program and keep trying to get people to work together a little better.

Mr. LIPSCOMB. Do you sit on the steering committee?

Dr. FRICK. I do.

Mr. LIPSCOMB. How often do they meet?

Dr. FRICK. Every 2 weeks. I have been to two steering committee meetings.

Mr. LIPSCOMB. What do they do there?

Dr. FRICK. Discuss the overall program and problems. I must say that the past two meetings we have discussed the overall problems of the center, entailing such things as the possibility of construction of facilities, a certain amount of speculation as to what will happen to the budget, and trying to lay plans depending on what happens to the budget. If, for instance, we received more money than we anticipated in certain areas, what would be the best way to get the project set up. At the last meeting, in line with the general policy of the steering committee, we had a presentation from several people in the geophysics section as to what they were doing, and reports from project engineers and others on the work they were doing.

Mr. LIPSCOMB. Since you have been there, do you feel a need for 1 administrator to coordinate the 3 directorates?

Dr. FRICK. No; I do not. The work of the different directorates is separate.

Mr. LIPSCOMB. Is there not some place where the three directorates come together? You must have some problems that are similar in nature.

Dr. FRICK. That sort of problem can, I feel, be handled by the steering committee.

Mr. MCCORMACK. People in one field may feel that money should be allocated to them rather than to another field. What is the story there?

Dr. FRICK. Probably the three of us, with General Maude sitting as chairman, would present our positions, defend our own positions, and ultimately the decision would have to be made by General Maude if it came to a place we could not agree. I know of no other way of handling it.

Mr. MCCORMACK. I could not agree to that. We have steering committees in Congress. We have a way of handling it. But if there were one business separate and distinct, I could see a difference. In other words, General Maude is the commander and he makes the decision?

Dr. FRICK. That is right.

Mr. MCCORMACK. Suppose it is a technical decision. Do you think a nontechnical man—I will leave General Maude's name out—do you think a nontechnical man who happens to be a commander is qualified to make a decision on strictly a technical question?

Dr. FRICK. Sir, I would be surprised if a technical decision such as you are talking about came to that point.

Mr. MCCORMACK. Suppose it came on a higher level, then.

Dr. FRICK. I think the technical decisions should be made by people who are technically qualified in the area in which the decision is to be made.

Mr. MCCORMACK. That is fine.

Mr. RIEHLMAN. Any further questions?

Mr. LIPSCOMB. How many civilian employees are there at Cambridge?

Dr. FRICK. In my directorate there are 380.

Mr. LIPSCOMB. Getting back to this administrative positon, a man with a lot of technical knowledge directing the 3 directorates, do you not think there should be someone who can analyze the problems of all 3 directorates?

Dr. FRICK. I find it very difficult to think of a technical man who would have good technical qualifications in electronics and geophysics both, or in the atomic-energy field.

Mr. LIPSCOMB. A general manager of a big corporation does not know every branch of the corporation, either. Yet he is general manager of the whole corporation.

Dr. FRICK. I am sorry. I am not trying to duck your question.

Mr. LIPSCOMB. You feel no need for an administrator at another level administering all 3 of these directorates who have big problems each of their own?

Dr. FRICK. No; I do not.

Mr. LIPSCOMB. The way it now works you must go to the military commander to make a decision you cannot make yourself and he does not always have the technical knowledge of your problem?

Dr. FRICK. That situation, I am sure, does exist and has existed and will exist again. Decisions of this sort tend to be cooperative. We are all working for the same thing. In military research and development we are faced with pretty fantastic responsibilities and problems. It is a difficult job, and we are all working together on it and I think you will find in the research and development program there is a minimum of self-aggrandizement or empire building.

Mr. MCCORMACK. I do not think that the Congressman has that in mind.

Dr. FRICK. For technical decisions we do have scientific advisers we can get in; we do have consultants we can get in; these are outsiders and we can present a technical problem to them. It has been my experience that the military commander—and this is also my impression of the higher headquarters—listen to these people, so we do actually get technical men in on the high-level technical decisions.

Mr. MCCORMACK. It is one thing to listen but the ability to decide is another thing. I could see where you might step into even geophysics, because your specialty is psychological; you are dealing with human beings, are you not?

Dr. FRICK. That is right.

Mr. MCCORMACK. You understand human nature, the influences of the human mind, and trying to bring about a satisfactory relationship. But an electronics specialist to step into geophysics, he might have some knowledge of it but there would be a lot of difficulty connected with his being a director.

Dr. FRICK. I should feel so, sir.

Mr. MCCORMACK. Even of necessity a fellow with your background could temporarily step in and sort of get along better than the one

who did not have your background but who might be a specialist in some other line. It is a related field. Would that be correct as a general proposition?

Dr. FRICK. Yes, sir. It is my opinion, which I have tried to state, that the individual concerned is of rather more importance that the particular paper qualifications, if you want, for that individual. That is for top management. I think that is generally true.

Mr. MCCORMACK. There is a lot of truth in that, as to the individual. But take a scientist. Suppose they were in this setup occupying a low level where their views can be presented. That is more than concerning the individual, is it not?

Dr. FRICK. Yes.

Mr. MCCORMACK. If they had, let us say, a Secretary of the Air Force for Research and Development, which I have been advocating, that is different.

Dr. FRICK. Right.

Mr. MCCORMACK. In other words, the fact that a man on the civilian side in this setup, which is most unusual—it is unusual; this is not the ordinary association of human beings. It is an unusual setup by reason of the background, the minds, studies, and experiences of the two essential groups which make it up. The question of representation of views, technical views on a high level, is a matter of great importance, is it not?

Dr. FRICK. That is right, sir.

Mr. MCCORMACK. Pardon me.

Dr. FRICK. Have we got any place at all in answering your question, sir?

Mr. LIPSCOMB. I am not completely satisfied, but I think we have gone as far as we can.

Just one other thing. What I would like to see is the maximum production in a laboratory, to get the most we can for the defense and progress of our country.

Dr. FRICK. Right.

Mr. LIPSCOMB. Do you feel that under the present setup at Cambridge that is possible, as you see it in 6 weeks?

Dr. FRICK. I think that it is possible, sir, to the extent that I can carry out my job adequately. In other words, to the extent that the Electronics Research Directorate, which is the only thing I can speak of with any knowledge at all, has good leadership—this affects the morale factor and other rather intangible things—I think we can, under the present organizational setup get an optimal output.

Mr. LIPSCOMB. Of course, after listening I am becoming more concerned each hour, because of the loss of Mr. Marchetti and Dr. Schneider, and now you speak of your next leading man, Dr. Huggins. Where is this going to stop? How can we effectively make service in this kind of a laboratory more appealing to our outstanding scientists so that we can get this ultimate research and development?

Dr. FRICK. I feel that the thing we must aim for is a certain amount of stability in the program. Not only in the program, but in the organizational structure and so on.

I am optimistic, let us say, about attaining the required degree of stability in Air Force research. If I were not I would be not in it.

We are going to lose good people. Industry loses good people. They switch around.

We are going to pick up some bright youngsters out of graduate school and that sort of thing, and they are in a sense going to replace the men we lose.

This process seems to me to be a continuing process. It is the sort of thing faced by the Bell Telephone Laboratories. It is the sort of thing faced by good university departments. There is a continual turnover of this sort.

Mr. McCormack. But not for the reasons of Marchetti and Schneider and some others.

Dr. Frick. The reasons of Marchetti and Schneider, sir, I do not know.

Mr. McCormack. I understand.

Dr. Frick. The reasons for Dr. Huggins' leaving are exactly the sort of reasons a very good friend of mine left the MIT faculty to accept a position at Harvard as of a month or so ago. This seemed to him to be a little better working atmosphere in some sense. He could do the things he wanted a little better. It seemed to fit in with his personality better.

This particular man was a scientist. MIT tends to run more toward engineers, and there is a little more activity, and a little less of the cloistered halls atmosphere feeling than there is at Harvard. This man felt he fitted better in the more protective atmosphere, if you want, of Harvard. Dr. Huggins, I think, felt exactly the same way.

I must say in this case, where I knew the man, I think he is probably right.

Mr. McCormack. In your case, suppose you were a general.

Dr. Frick. Yes, sir.

Mr. McCormack. You would consider yourself a research psychologist, would you not?

Dr. Frick. Yes, sir.

Mr. McCormack. Just like the Medical Corps. I call up men who are high-ranking men, and they always answer "Dr. So-and-So." That is invariably true. They have the mind of a doctor.

You have the mind of a scientist. So do the other men in the field of science.

An engineer has the mind of an engineer. No matter what his rank is, he is an engineer.

I can see where men in the infantry and the artillery—with no criticism—have the mind of rank. Do you get the difference? There is a marked difference.

Dr. Frick. Yes, sir.

Mr. McCormack. There is a marked difference. There is a difference in the state of mind which approaches a particular thing. You get a man strictly with a military background, essentially with a military background, and put him over men who are scientists or men who are doctors, and that man will create more conflicts than if the commanding officer is a scientist, will he not, as a general proposition; or is more likely to bring about friction? We are not talking about cases. We are only in a broad field. We are just groping.

Dr. Frick. May I say I think the probability of friction would be greater.

Mr. McCormack. Do you have Plans and Operations under you in connection with electronics?

Dr. Frick. Yes, sir.

Mr. McCormack. Has there been any interference?

Dr. Frick. No, sir.

Mr. McCormack. In the 6 weeks you have been there, by General Maude?

Dr. Frick. None whatsoever, sir.

Mr. Balwan. Excuse me, Mr. McCormack. I think Mr. McCormack is referring to Plans and Operations that is above you. Is that right?

Dr. Frick. Right. I have a Plans and Operations Branch. Actually, it is called Plans and Requirements Branch for the Directorate. There is in addition a Plans and Operations Branch for the center. This is not under me. We actually work with these people.

Mr. Lipscomb. Have you had any occasion to be in touch with Plans and Operations, inasmuch as nothing has been done on your program since you have been there?

Dr. Frick. Very limited contact. As I pointed out to you, our plans were set, went in with the budget, and the wheels will start spinning again very quickly, as soon as we get word on the final state of the budget and see how we are going to have to shuffle or reshuffle, or what our budget limits are going to be.

Mr. McCormack. On the Plans and Operations at the center, are they principally officers?

Dr. Frick. No, sir. There is a deputy for operations who is an officer, Colonel Adams. He has underneath him a civilian, Mr. Green, who I believe is head of plans and operations in the center. He has a fairly large civilian staff. He has 1 or 2 officers. I cannot give you the figures on this. It seems to be pretty well mixed, officers and civilians.

Mr. McCormack. From the angle of scientists, what is your viewpoint as to the officers, leaving General Maude out, assigned up there? Never mind the airbase.

Dr. Frick. Right.

Mr. McCormack. The operational side. I am talking about the research.

Dr. Frick. We get a large number of young officers assigned to us. These are essentially men that are out of ROTC. They will ordinarily have at least a bachelor of science degree. In some cases they may have an advanced degree or engineering degree. These people work into the labs. They work into the operations, into our research operations, in exactly the same capacity that a civilian with comparable background and training would work in.

I have asked some of my lab chiefs how this is working out. They like it very much. They get good people. They are generally younger men. They are bright. This has worked out very nicely indeed.

In addition to this there are higher ranking officers, for the most part, who work on the center level. These make up General Maude's staff.

I can only say my personal experience in working with the particular group we have there has been very pleasant indeed. They have been uniformly helpful where I needed any help at all. They have essentially been very good people to work with. These are essentially nontechnical men. This is the operational side of the center.

I am not clear on the details of how the thing operates. Probably General Maude spoke about them. I do not feel competent, for

example, to go into exactly what the deputy for materiel does, or what his responsibilities are. He has, in actual fact, turned out to be a fine man to work with.

Mr. RIEHLMAN. Any other questions?

Mr. LIPSCOMB. No, sir.

Mr. RIEHLMAN. Any other questions from the staff?

Well, thank you, Dr. Frick, for coming down and giving us this information.

Dr. FRICK. Not at all, sir. One question: I have undertaken to supply an answer in writing on my opinions of research in the military. Would you care to state this a little more exactly?

Mr. BALWAN. We will send you a quotation from the transcript in which the question will be restated to you.

Dr. FRICK. Fine. In which case what do I do about getting it back to you?

Mr. MCCORMACK. Off the record.

(Discussion off the record.)

Mr. RIEHLMAN. We will stand adjourned until 2:30.

(Thereupon, at 1:20 p. m., Friday, June 11, 1954, a recess was taken until 2:30 p. m. of the same day.)

(Discussion off the record.)

STATEMENT OF COL. WILLIAM S. HEAVNER, DEPUTY CHIEF OF STAFF, ROME AIR DEVELOPMENT CENTER, ROME, N. Y.

Mr. MORRIS. Colonel Heavner, just to get started, and for the information of the subcommittee, and for the record, could you state just briefly a little bit about your yourself, your personal history and educational background, your working experience and your military record up to the time you came to Rome Air Development Center?

Colonel HEAVNER. My background is, educated in the school at Girard College, Philadelphia, where I took my elementary education, and then I took a bachelor of science degree at Drexel Institute of Technology in electrical engineering. After that I completed my master's work in electrical engineering at the University of Pennsylvania and completed the management in the research and development course at the University of Chicago.

Academically that is the scope of my education.

I took a job in 1934 with RCA, Victor division, and worked in several jobs for them in engineering. In 1941 I left the research and development activity at RCA and was assigned in the Signal Corps at that time, and worked with the Air Force—detailed to the Air Force as a matter of fact—and went through the war and was separated in 1945. Came back to RCA and continued with my research and development work for 6 months and then took a regular commission in the Air Force and came back on duty as an Air Force officer. I was assigned to the Watson Laboratories in 1949 and was at Watson Laboratories until 1950 when I left to go to the University of Chicago.

In 1952 I came back to the remaining contingent of Watson Laboratories, which was then placed at Rome Air Development Center at Rome, N. Y., and am currently assigned there.

Mr. MORRIS. Colonel Heavner, you are the Deputy Chief of Staff for Research and Development at the Rome Air Development Center at Rome, N. Y. Is that correct?

Colonel HEAVNER. I have to be current. At the present time I am on my way to Korea so I am assistant to the commanding general of the Rome Air Development Center for a short period. I went on leave for Korea the 23d of this month.

My former job was the Deputy Chief of Staff for Research and Development.

Mr. MORRIS. That was until just recently—within the last few weeks?

Colonel HEAVNER. That is right. Let me say June 1, as a matter of fact.

Mr. LIPSCOMB. What reorganization is being done at Rome to replace you?

Colonel HEAVNER. It is quite an extensive change, and I can clarify it this way. The base is being turned over to the Air Materiel Command under the supervision of the Rome Air Force Depot. It used to be a research and development base. In making this decision it was necessary then to take the Rome Air Development Center personnel and change them from base operating people to just research and development activities. In making this decision the commanding general who used to run the base will now run just the research and development.

This in effect puts him in the job I used to have so, that there is no authorized Deputy for Research and Development, for the commanding general assumes this position.

Mr. MORRIS. And this change becomes effective July 1?

Colonel HEAVNER. July 1. That is right. It is going on right now in mechanics and so at present there is no Deputy Chief of Staff for Research and Development. This has caused an internal realinement, so that as I say they abolished that position and the commanding general now has the position of running all of the research and development.

Mr. LIPSCOMB. What is his background?

Colonel HEAVNER. That I am not sure of. I have just known him for about 2 weeks now. I know he has gone to Harvard Business College. I am not sure what his electronics background is. He did not go to the Academy. Other than that I cannot tell you what technical background he has.

Mr. LIPSCOMB. Is Rome primarily considered, or does it primarily work on electronics devices?

Colonel HEAVNER. At the present time the answer is "Yes." They do have two important missions. One is electronics as such; and the other is an intelligence and reconnaissance mission, which has all of the facets attached to it, including the planning and analysis of deficiencies in the field of intelligence and reconnaissance—not necessarily just electronics.

Mr. LIPSCOMB. How many civilians are there?

Colonel HEAVNER. In the research and development activity there is roughly 1,000 right now. 1,050.

Mr. LIPSCOMB. How many of those are scientific and technical personnel?

Colonel HEAVNER. About 350 approximately.

Mr. LIPSCOMB. And you are in charge of the 350?

Colonel HEAVNER. Well, the entity that used to be under the laboratory structure was 900 approximately when I was running it.

Since the center staff moved down, that is, the research and development staff, it has been consolidated under the one figurehead, the general, which has now moved up the total to about 1,050.

Mr. LIPSCOMB. What was the highest civilian position at Rome?

Colonel HEAVNER. In rating?

Mr. LIPSCOMB. Yes.

Colonel HEAVNER. The highest one is Mr. Davis who has a Public Law 313 position.

Mr. LIPSCOMB. What is his title?

Colonel HEAVNER. He is called the Technical Director.

Mr. MORRIS. Mr. Balwan suggested that to maintain the chronology, might we start with the place where Colonel Heavner left off, bringing us up to the period where he had come to Rome, and let the colonel tell us the organizational structure of the Office of the Deputy Chief of Staff for Research and Development as of that time. When did you come up to Rome from Watson Laboratory, Colonel Heavner?

Colonel HEAVNER. I did not come from Watson. I told you I came to Chicago and then was returned to Rome Development Center in 1952.

Mr. MORRIS. The Watson Laboratories, which were in New Jersey, had moved up to Rome around 1950?

Colonel HEAVNER. 1950–51.

Mr. MORRIS. Can you tell us the organization of your directorate there at the time you came in? There was a Deputy Chief of Staff for Research and Development, and you filled that position.

Colonel HEAVNER. All right. The organization as such, when they created the Deputy Chief of Staff for Research and Development, consisted of a Plans and Operations Staff, a Technical Director, four divisions under this particular entity. These four divisions constituted the engineering support. That was one.

Mr. MORRIS. That is the Engineering Support Division?

Colonel HEAVNER. That is right. And three other divisions.

Mr. MORRIS. Were those Divisions, Electronic Warfare and Techniques Divisions——

Colonel HEAVNER. That is right.

Mr. MORRIS. Which is at Rome now. The Equipment and Development Division, and the Systems Division?

Colonel HEAVNER. That is correct. That is the old organization. As I say, now they are going through an internal reorganization which will change this to 4 directorates, and these 4 directorates if you would like to know the names are electronics, intelligence and reconnaissance, technical services, and flight test and instrumentation.

Mr. MORRIS. Who were the personnel in these positions when you first came to Rome, Colonel Heavner? Could you tell us the names of the technical director and the chief of each division?

Colonel HEAVNER. When I first came to Rome—I have to admit that when I first arrived this organization pattern that you have just discussed was not the one in existence at the time. That was a reorganization that I had helped with, about 6 months after my arrival. Would you like to know the people in charge at that time, or when I first arrived? There is a difference. That is the point.

Mr. MORRIS. Give us the organization when you first arrived if your could, and then describe the reorganization and what it meant in terms of functions also.

Colonel HEAVNER. When I first arrived Mr. Cole was in charge of the technical director's office and I believe they called him the technical director at that time to the best of my recollection, from the chart's standpoint.

The substructure—the laboratory substructure itself—was basically the same as we have indicated here with four divisions, and at the time they were headed up by Mr. Schlegelmilch, Mr. Dunn; and a Mr. Tolman was in charge of Plans and Operations Office at the time; and a Mr. Sherman and Friedman were in the Plans and Operations Office as chiefs—co-chiefs of the office.

Mr. MCCORMACK. Were they all civilians?

Colonel HEAVNER. Yes, sir.

Mr. MORRIS. And the mission of this Office of Research and Development at Rome at that time was substantially the same as it is today? In general terms what did you do? Were you doing the same type of develpment work you are doing today?

Colonel HEAVNER. I would say it is exactly the same except for the intelligence and reconnaissance function, which was not assigned to Rome at that time. It is a new mission and has been assigned in the last year. And electronic warfare as well.

Mr. MORRIS. The Intelligence Division has just recently been established within a matter of weeks. Is that correct?

Colonel HEAVNER. No, sir. I can only say this: The intelligence and reconnaissance mission was assigned to Rome within the last year. About 11 months ago to be exact. That mission gave us the authority to establish an entity called intelligence and reconnaissance, and we have been working on that ever since. It has now been built up to a rough figure of, let us say, 50 people—35 to 50.

Today I couldn't tell you exactly what it is because of hiring processes.

Mr. MORRIS. Could you tell the committee in describing the mission of Rome just very briefly, what some of the development projects have been up there at Rome, and what part each of these divisions has played in them?

Colonel HEAVNER. That is a rather broad question, but I will do what I can to clarify it. The basic functions by Rome air development have been in the field of electronics. In this particular field we have the radar equipment that goes along with the Air Defense Command activities, so that the majority of the radar work for the Air Force had been done by the Rome Air Development Center. This was carried out by the Equipment Division.

In addition the Technical Air Command requirements for communications, radar, and navigation were also functions carried out by the center as a whole. The Equipment Division, of course, making the hardware items for the end products. Electronic Warfare and Techniques Division, which is currently operating, is responsible for determining the components or techniques to use before you develop a piece of hardware. In other words, determining what you would like to do and agreeing that it is feasible to do it before you come up with an end item of hardware.

The Systems Division is such that it was responsible for any systems problems that were assigned to the Rome Air Development Center from the Air Research and Development Command. This involves such things as a return to base capability which means the ability to

take aircraft 200 miles out and have them land safely; or to consider the Tactical Air Command as a system problem and figure out what it takes to get the Tactical Air Command to operate both in locating their aircraft, or direct them to have bombing or navigation machines to send them out and do reconnaissance work and come back safely. That is the type of work carried out by the Systems Division.

The Engineering Support Division, or directorate, as it is now, does expressly what it says. It supports the engineering functions by carrying out the miscellaneous work of drafting, making prints, library activities, doing specification writing in support of the engineers with any type of help they need administratively.

That roughly covers the scope of the activities.

Mr. MORRIS. Colonel Heavner, putting aside for the present time this organizational change which will somewhat subordinate the activities at Rome to Cambridge, and discussing this Rome Air Development organization as it was when you came, and during most of your tenure at Rome, what is, generally speaking, the relationship between the Rome Air Development Center and the Cambridge Research Center? Do they complement each other on a lot of problems, or do they both do a great deal of work in which they have no relation to each other?

Colonel HEAVNER. I think I know what you are getting at.

Mr. MORRIS. What is the significance of the word "research" and the word "development" in their various designations?

Colonel HEAVNER. I think the problem is one we are all aware of: That semanticswise we can hardly define what you call research, and what you call development. As far as the two centers were concerned, we tried to agree they have a similar function, and in order to cut out any duplication or parallelism that is unnecessary we have talked in each instance when we had development work to see whether Cambridge has the responsibility and capability of doing it, or whether Rome should be doing it.

This as I say has been a matter of discussion. There is no such thing from my experience as saying that the Cambridge Research Center just does research and, therefore, does not have any duplication possibilities since Rome is charged with development.

These two things are not clear from the standpoint of definition or semantics. Both of us have the mission allowance to do research and development in the field of electronics; but by mutual discussion and coordination it is possible to keep duplication to a minimum or getting on a parallelistic approach if it seems to be feasible.

Mr. MORRIS. Up to the present time both Rome and Cambridge have reported directly through commanding officers to ARDC, Air Research and Development Command, in Baltimore. Is that right?

Colonel HEAVNER. That is correct.

Mr. MORRIS. For instance, what is the comparison between the facilities at Rome and those at Cambridge? How large is Rome in terms of physical equipment, personnel, and function in comparison with Cambridge?

Colonel HEAVNER. You have me a little bit confused on this question from this standpoint. I only think of Cambridge from the electronics standpoint and that they have a great deal more than just electronics.

Mr. MORRIS. And your relationship with Cambridge is largely in the electronics field?

Colonel HEAVNER. Yes.

Mr. MORRIS. You have no relation to their unit of geophysics or atomic warfare?

Colonel HEAVNER. That is correct. But as I say, from the electronics standpoint I think their organization has about 300 electronics people actively engaged; and our electronics effort runs to 900 people. I would say we are roughly 3 to 1.

Mr. MORRIS. Could we go back again to this organizational evolution? Would you describe how the Office of Deputy Chief of Staff for Research and Development was set up at the time you came to Rome? Could you relate for the committee in chronological order the evolution of that organization from that time until your relinquishment of the Office of Deputy Chief of Staff there?

Colonel HEAVNER. Perhaps I don't quite get the sequence of your questioning, but it sounds to me like you want me to start from the time I arrived.

Mr. MORRIS. Yes, sir.

Colonel HEAVNER. I can merely tell you there was an organization in being. I don't know what the chart picture was.

Mr. MORRIS. Yes, sir.

Colonel HEAVNER. I don't know exactly what the scope and functions of each entity might have been, but I am sure it was very similar to what we discussed in meetings as soon as I arrived there. Within 6 months we merely reoriented the activities so that we went into what might be described as the components or techniques organization; the equipment for creating the techniques and the systems aspect with the engineering support.

As I say, this was done within the first 6 months after my arrival. Then for the next roughly a year and a falf—and that is almost up to the current time—we continued with that organization; and as I say, with the center organization, giving up the base, the internal alinement is being changed today. That is the transition that has occurred.

Mr. MORRIS. I understand that. But then as you view it you took over an existing organizational structure and you continued to run it for about 6 months during which time you discussed and formulated a new organizational concept. Do I understand you to say you did not fundamentally change the organization, but that you shifted some functions within the organization? In other words, were the boxes on the chart substantially the same as they had been when you came, although you realined some functions and responsibilities, and perhaps lines of command?

Colonel HEAVNER. That is correctly discussed. As far as I can remember the organizational pattern, as I say, it was not a complete upheaval. It was merely reorienting the boxes to get a better integration of the activities.

Mr. MORRIS. Could you describe what that reorientation amounted to? In what respects was it a reorientation?

Colonel HEAVNER. For instance, the concept that was brought from Watson Laboratory days was one which said that you would have by definition a radar laboratory, a communications laboratory, a navigation laboratory. And this is saying that——

Mr. MORRIS. Within each of these divisions?

Colonel HEAVNER. This is the division itself. They are the basic divisions. And rather than to leave these divisional elements the way they were and put up with the confusion which came out of it, which said if you have the radar and the radar happens to be applicable both to navigation and to radar activities, then where do you assign it or have your effort? This gave me the possibility of having two places to carry out that activity.

For instance, in radar that does navigation work, it is naturally a navigation item of equipment and also radar, and therefore could be assigned to the radar laboratory.

To cut this duplication in keeping talent available in two spots, we merely said it would be smarter to consolidate, so that we went through the logical cycle of saying let's get a techniques component element started and then phase that into the end item of hardware, which would be called equipment, and then put it into a system to see if the system would work; and, of course, support it with the engineering support.

That was the concept that gave rise to this reorganization.

Mr. MORRIS. So there was a reshifting of the relationship between the laboratories at this division level? There was no change in the staff above the operational laboratory or divisional level, to speak of?

Colonel HEAVNER. Well, to speak of, as you would put it, the plans operation was separate from the Operations Office and this led to trouble because the two of them had to work together. So, to eliminate that, we put them together and called it the Plans and Operations Office.

Mr. MORRIS. That was a staff office?

Colonel HEAVNER. Yes; then we had an administration office. The administration office did the normal adjutant's office work, or the paper work, seeing that the proper administrative procedures and policies are established.

Mr. MORRIS. Where did the Technical Director fit into the organization. Was he considered to be a staff officer or was he considered to be a superoperational officer or both?

Colonel HEAVNER. Well, the concept was to place the Technical Director immediately under the Chief or the Deputy Chief of Staff, as I remember it, for Research and Development.

Mr. MORRIS. At the time you came, that was the organization?

Colonel HEAVNER. Yes, sir.

Mr. MORRIS. Which you inherited?

Colonel HEAVNER. Yes, sir; which I inherited, and it was carried over the same way. Since this was operating the laboratory, it put the Technical Director as an adviser to whoever ran the laboratories.

Mr. MORRIS. According to your understanding, the Technical Director was an adviser to the military Deputy Chief of Staff for Research and Development and was never considered either on an organizational chart nor in actual working operation to be directly in line of command between the commanding officer and the operational laboratories or divisions? He was an adviser to and, say, if you were going to draw an organizational chart, he would be in a box off to the side.

Colonel HEAVNER. Yes, sir.

Mr. MORRIS. And that is the organization you inherited?

Colonel HEAVNER. Yes.

Mr. MORRIS. Who was the Technical Director when you came in?

Colonel HEAVNER. The Technical Director was Ralph I. Cole.

Mr. MORRIS. How long did he remain there?

Colonel HEAVNER. Roughly, 6 months after I arrived. I made the move from Watson and I knew him at that time.

Mr. MORRIS. Although you had gone to Chicago in the Management School in the interim and Mr. Cole had shifted to Rome, and when you came up, your predecessor was Colonel Bennett.

Colonel HEAVNER. Yes.

Mr. MORRIS. And Mr. Cole was his Technical Director and you inherited Mr. Cole as your Technical Director, and within 6 months after your coming, he left the Rome Laboratory?

Colonel HEAVNER. Yes.

Mr. MORRIS. What date would that be, about?

Colonel HEAVNER. Roughly, August.

Mr. MORRIS. Of what year?

Colonel HEAVNER. 1952.

Mr. MORRIS. Who succeeded Mr. Cole?

Colonel HEAVNER. Mr. Davis.

Mr. MORRIS. And Mr. Davis is your Technical Director today?

Colonel HEAVNER. Yes.

Mr. MORRIS. Was there any other organizational change that took place in this place at the staff level at the time Mr. Cole left, or prior to the time Mr. Cole left?

Colonel HEAVNER. Other than this consolidation of this Plans and Operations staff, I do not think there was any change.

Mr. MORRIS. Was there ever formed to assist you or to assist the Technical Director or to assist both of you a research advisory board or whatever it might be called?

Colonel HEAVNER. The Development Advisory Council.

Mr. MORRIS. I don't know the proper title for it.

Colonel HEAVNER. This was something else which, if I can get your thinking, it was an allowance for the center commander to have the Development and Advisory Council and this was assigned, not at my level, but way up at the commanding general's office where there was a box off to the side which gave him the allowance to have consultants in at the call of either the president of the Advisory Council or the general.

Mr. MORRIS. This was the commander of the center?

Colonel HEAVNER. Yes.

Mr. MORRIS. Who was also your superior?

Colonel HEAVNER. Yes, sir.

Mr. MORRIS. And this Research Advisory Council, were they people employed at the military base or private citizens from the outside?

Colonel HEAVNER. They were private citizens from the outside, universities, all of them. They were Ph. D.'s from the various universities.

Mr. MORRIS. Was that organization present when you came to Rome?

Colonel HEAVNER. Yes; it was.

Mr. MORRIS. Is that organization existing today?

Colonel HEAVNER. Well, we are just in the transition point again whereby you will find it is being eliminated currently, and should be no longer a development advisory council. The commanding general who just left, General Doubleday, decided to abolish it and it was eliminated in current reorganization.

Mr. MORRIS. How did they prepare work for the center? They were not employees of the center.

Colonel HEAVNER. They were consultants and hired as such and called in for a consultant's requirement by the day and paid accordingly.

Mr. MORRIS. They were leading scientists or leading engineers? For instance, who would be on this council?

Colonel HEAVNER. Well, for instance, Dr. Williams, and I believe he was from Carnegie. They had a doctor from Syracuse, and I don't know his name.

Mr. MORRIS. That is Syracuse University?

Colonel HEAVNER. Yes. And any individual that the commanding general would like to have for special advisory consultant work, he could put on this committee. There were five on this particular committee at that thime.

Mr. MORRIS. That was a standing committee which could be called into consultation on special problems from time to time and possibly paid on a per diem basis?

Colonel HEAVNER. Yes, sir.

Mr. MORRIS. And aside from that, and that advisory board which was at the commanding general level, which was over and above the actual office of the Deputy Chief of Staff, and the office you held and the office which directly supervised the development work at Rome, was there such an advisory board, and I do not mean was there a similar advisory board but was there an advisory board at any time within your office composed, as I understood from having talked to you previously, of the heads of the various divisions and possibly other officers within you office? Could you describe that?

Colonel HEAVNER. There was what we called a technical steering group.

Mr. MORRIS. When did that come into being?

Colonel HEAVNER. Well, they created that about 10 months after I arrived and this was under the control of the technical director. It was called a technical steering group and it was composed again of any number of chiefs of the projects office or projects-level individuals who would be necessary to direct any technical problems.

Mr. MORRIS. How often would they meet? Would they meet subject to the call of the technical director or would they meet regularly?

Colonel HEAVNER. They would meet at the call of the technical director and it was ordinarily instituted by the plans and operations personnel presenting the problem and saying it should be discussed at the technical steering group meeting.

Mr. MORRIS. Would it be composed of different people at different times, depending on the problem discussed?

Colonel HEAVNER. That is right.

Mr. MORRIS. For instance, if there was a problem which primarily arose at the engineering support division, and at times it would include

the chiefs of the various divisions, but it would be supplemented possibly by members of the particular division which had a problem.

Colonel HEAVNER. That is right. It was used to discuss our technical problems and to be able to evaluate it and have an open hearing of the pros and cons as to why we should or why we should not carry out a program discussed at Plans and Operations.

Mr. MORRIS. There had been no such steering committees prior to Mr. Cole leaving and Mr. Davis assuming the office of the technical director?

Colonel HEAVNER. That is correct.

Mr. MORRIS. Is there any relationship between the fact that Mr. Cole did leave and the fact that such a technical steering committee was formed or, to put it another way, were the functions of the technical director changed so that the functions were transferred to the steering committee which originally had been located in the office of the technical director?

Colonel HEAVNER. Well, there was no real change of the functional allowance for the technical director. He always had the prerogative of calling the group together for a technical discussion of evaluation, but it seemed logical, from my experience and Mr. Davis' thinking, that such a technical steering group could make a better approach to evaluating the program than just one man calling a group of people together to suit his requirements.

Mr. MORRIS. How had Mr. Cole operated at the office of the technical director? What was the nature of his Assistant to the Deputy Chief of Staff for Research and Development, how did he maintain real liaison with the division and what was the nature of his responsibility, both to the Deputy Chief of Staff and the divisions? What were the nature of his duties?

Colonel HEAVNER. Well, the reaction that I, at least, analyzed and evaluated at the time of my arrival, was that Mr. Cole was running the entire program and not the Deputy Chief of Staff for Research and Development or whatever title Colonel Bennett had assumed previously.

Mr. MORRIS. Your predecessor?

Colonel HEAVNER. My predecessor; and my evaluation was that if I was to assume management and responsibility for the laboratory, I would then have to take this prerogative for management without subdelegating it completely and not being involved in the operation of the laboratories.

Mr. MORRIS. So, in effect, although Mr. Cole, as technical director, might be called or termed an adviser to the military Deputy Chief of Staff for Research and Development, it was your understanding that he operated more in a line capacity?

Colonel HEAVNER. That is right; he actually had assumed—whether it was organizationally spelled out or not, but in actuality he had been carrying direct supervisory functions over the four divisions of the center and he had been maintaining an advisory capacity to the commanding officer. He had actually been a superchief of the divisions.

Mr. MORRIS. And he reported to the Deputy Chief of Staff for Research and Development. Did he or did he not necessarily have to have ratification or approval for all his actions from the military commander?

Colonel HEAVNER. At the time of my arrival, he definitely was running the laboratory from a command standpoint with line authority and assuming at least the prerogatives of having the complete control of the laboratories.

Mr. MORRIS. And you conceived that to be at variance either with your conception of how such a military laboratory should be run or possibly at variance with the Air Force official policy toward the running of the Rome laboratories, and there was a possibility at least in your view that Mr. Cole had either usurped or developed on his own initiative some power and authority not conferred on research directors in such laboratories?

Colonel HEAVNER. That is correct.

Mr. MCCORMACK. What evidence can you give us of that?

Colonel HEAVNER. I can say that Mr. Cole was in a unique position and what I have heard—if you have listened to Mr. Cole—you will be aware of the fact that he had the position of running the laboratory as a military man and he also assumed the responsibility of running the laboratory as a civilian afterward.

This is after 1945 and then, of course——

Mr. MORRIS. This was at Watson?

Colonel Heavner. Yes.

Mr. MORRIS. He had been an officer at Watson and then later on stayed on as a civilian.

Colonel HEAVNER. Yes. So he had a rather large background in the operations of the Watson Laboratory activities which, of course, turned into the Rome Laboratories, and naturally he was in a position to feel as if he had control and to really have control over a lot of people who had respect for him and also had some fear for him, I am sure, since he had control over a great many people right in the palm of his hand and the assignment of key jobs and the promotional aspects were certainly controlled by Mr. Cole at the time of my arrival.

This was quite interesting to see.

Mr. MCCORMACK. Did he have any written instructions?

Colonel HEAVNER. Yes, sir, there was a job description, I am sure, at the time, which gave him functional allowance in the job description as to the scope of his work.

Mr. MCCORMACK. Don't you think we ought to have that as to whether or not that would be important on whether Mr. Cole, as technical director, or whether the technical director was simply a supervisor or whether he had some other responsibility?

It seems to me that a technical director might be given some more responsibility than just advising, but it is according to what the instructions are and I think we ought to have them.

Mr. MORRIS. I do not have a copy of it here but I am sure it can be inserted into the record at this point.

Mr. MCCORMICK. It seemed to me that there must be somewhere written instructions.

Mr. LIPSCOMB. Did you say that they were available.

Mr. MORRIS. I do not believe that we have in our files at the present time the job description as it existed at the time Colonel Heavner came to Rome, which would be the job description Mr. Cole was working on as technical director. I am sure we could get that and put it in the record at this time. I thought that we could possibly proceed by stipulation more or less as to Colonel Heavner's understanding.

Mr. BALWAN. Would you be able to get the job description from Rome?

Colonel HEAVNER. This is what I am talking about. We have the records disposal technique of where we send them down to the Central Files at St. Louis and how fast they turn these records over, I don't know, but I am sure if they keep such records, we can find copies that should be on file.

Mr. MCCORMACK. May we be off the record at this point?

(Discussion off the record.)

Mr. MCCORMACK. The inference I draw, Colonel, in the testimony you have just given, where Mr. Cole had the prerogatives of the commander of Rome and had the people in the palm of his hand and promotion and fear and so forth, that is quite a criticism of your predecessor.

Do you care to answer that question or do you want to leave it rest to my observation?

Colonel HEAVNER. I think your observations are good. Let us put it that way.

Mr. MCCORMACK. Where is your predecessor now?

Colonel HEAVNER. Colonel Bennett is in the Philippine Islands and should be returning to the United States in August.

Mr. MCCORMACK. What is he doing in the Philippines?

Colonel HEAVNER. He was the Director of [1]Communications for the 15th Air Force.

Mr. MCCORMACK. That is related to the practical experience of the laboratory work?

Colonel HEAVNER. You can say that it is the operational side of using the equipment which might be developed.

Mr. MCCORMACK. And you are going to Korea in what capacity?

Colonel HEAVNER. I am going as the commander of the 502 Tactical Control Group and this is an operational entity, not research and development, but it will give me a chance to see the equipment that they use and interpret the requirements and deficiencies that might exist at the Tactical Air Command area.

Mr. MCCORMACK. All right. I was not interrupting you. Go ahead. I just asked a few questions that came to my mind.

Mr. MORRIS. Yes, sir. You were saying that Mr. Cole had been at Watson as an officer and then stayed on as a civilian. This is another matter that we can find out by independent testimony also, but when did he come to Watson? I am asking you with a view to establishing how long he had been there. I am assuming that the Watson Laboratories were moved to Rome and, roughly, his duties at Watson had been similar to those which he later held at Rome.

Over how long a period would you say he had been in this position of more or less supervisory chief or acting supervisor of the laboratories?

Colonel HEAVNER. Well, without all the continuity, I could not tell you exactly what his tenure might be in that particular position. I only know that when I arrived in December 1949 he was in a position of, not technical director, but assistant to the Watson Laboratory commanding officer at the time and as a technical supervisor but not as a technical director.

Mr. MORRIS. That did not happen to be Colonel Bennett, did it?

Colonel HEAVNER. No, that was Colonel Pachinsky.

Mr. MORRIS. He was succeeded by Colonel Bennett, your predecessor.

Colonel HEAVNER. Yes, Colonel Pachinsky, later General Pachinsky.

Mr. MORRIS. Possibly you might say it would be a fair statement that for roughly 7 years prior to Mr. Cole's leaving the Air Force, he had been holding this position of supervisor of the technical activities both at Watson and then later on at Rome?

Colonel HEAVNER. May I qualify that by saying that yes, roughly 7 years on and off he had been doing that because he was superseded again by a military officer, even as a civilian, that is, the military men took over and assumed the control of the laboratories.

Mr. MORRIS. He more or less switched places and became the civilian technical director, and another man came in to take over as military director?

Colonel HEAVNER. Watson was commanded as a complete entity by a commanding officer. The laboratories were an entity and Mr. Cole was only associated with the laboratory part of it and not the maintenance and the other adjuncts that went with it, the controller's office and the reproduction and the shops.

Mr. MORRIS. Could you relate for the subcommittee what you conceive to be the circumstances under which Mr. Ralph Cole left Rome and was replaced by Mr. Davis?

Colonel HEAVNER. Well, I can tell you exactly what caused it if you would like me to follow on that approach.

Mr. MORRIS. If you would, please.

Colonel HEAVNER. The reason for the reaction which started with Mr. Cole was that upon my arrival, and assuming the responsibility for the laboratories, I decided to attend the meetings, the daily or weekly meetings held by the laboratories, and in my first appearance at the laboratory meeting I found that there were approximately 72 people sitting for an hour and fifteen minutes discussing a lot of generalities, with only two people taking notes from the meeting. One of the people happened to be myself.

Mr. MORRIS. Where did these meetings take place and generally who would be there?

Colonel HEAVNER. This was the responsibility of Mr. Cole. I found out that Mr. Cole decided to have meetings every week and the laboratories put on a meeting every day. That is, the navigation laboratory had a meeting on Tuesday and radar on Wednesday and communications on Thursday and the support laboratory on Friday.

Mr. MORRIS. And he, as Technical Director, would go around?

Colonel HEAVNER. Yes, and he would have them come and talk to him and discuss the current problems and programs and a lot of generalities.

Mr. MORRIS. And in addition to those individual meetings with individual projects of the individual laboratories, there were these weekly meetings with representatives of all the divisions, is that correct?

Colonel HEAVNER. Not at that time, no. To the best of my knowledge, this was the scope of the meeting. They were held on a recurring weekly basis in which they just repeated the same cycle of scheduled meetings which Mr. Cole attended from Tuesday to Friday.

Mr. MORRIS. Generally, there would be Mr. Cole as technical director, and then there would be the chief of the particular division in which the meeting was being held?

Colonel HEAVNER. Yes, and anybody else who wished to attend or who presumably wanted to attend could attend it. I noticed in my first meeting that there were several people from the plans group and I raised a question as to why were the plans people attending this meeting in volume, and they said they had heard that I was going to attend this first laboratory meeting and therefore felt that they would like to see what was going on.

My immediate reaction to the entire procedure was to have an open forum discussion and, unfortunately, Mr. Cole had a visitor with him at the time and asked to be excused and he left the meeting. I tried to interpret it and what good it was doing and whether the people in attendance felt it was worth while, and in other words called for a group of high-level people at a meeting without more return than I thought was being derived.

The open discussion seemed to be that they wanted to have this contact with management and did not like the idea of eliminating these meetings entirely.

After the meetings, a few of the plans people whom I had noticed had come back to Mr. Coles with the complaint that they did not like the way that I had checked on the management of his meeting and that they felt this was Mr. Cole's meeting and I should have waited for him to raise the questions. This presumably got Mr. Cole riled up and he asked to have a discussion with me, and we had a discussion, at which time he stated that he did not like this at all and he would not tolerate it and he would not work like he used to work at Watson with the Military controlling it, and if I ever did begin, he would resign and not only would he resign but he named 4 or 5 people who would also resign if he did.

Mr. MORRIS. Were these 4 or 5 people chiefs or subordinates to him?

Colonel HEAVNER. They were high-level people.

Mr. MORRIS. All civilians?

Colonel HEAVNER. All civilians, correct.

So I listened to this discussion and then left the office. It was his office at the time.

I went back to work and thought it over during the night and decided that this did not sound very sensible to me and I would like to have another meeting the next day and call the people who had agreed to resign with him, presumably.

The next day I did call the meeting and, to my amazement, several of those who were named as making these statements of resignation got quite bothered and refuted the statement immediately and said they were not true at all but said they would not resign, and this gave me a fairly good indication of Mr. Cole's integrity and the fact that I could not trust him if he was going to continue to operate like this.

So I immediately reported back to my supervisor that I figured Mr. Cole could not be trusted and, from where I sat, if he was objecting to being managed and they wanted me to manage the laboratories, I would relieve him as the technical director. This was agreed to and I called Mr. Cole into the office in about 3 days and told him he was relieved as technical director, without prejudice, however, and that I would let him decide what to do next.

At this time he stated then he would resign.

Mr. MORRIS. And he did resign?

Colonel HEAVNER. Yes, he did resign 4 or 5 months later with a liberal allowance to clean up his affairs and get his children out of school. We were most considerate of Mr. Cole.

Mr. MORRIS. And he left in July 1952 or early summer of 1952.

Colonel HEAVNER. In August, roughly.

Mr. MORRIS. He was replaced by Mr. Harry Davis?

Colonel HEAVNER. That is correct.

Mr. MORRIS. And you have stated that there were some changes at that time in the scope of the authority and the functions of the technical directorship which was assumed by Mr. Davis. Were those changes reflected in the changes in the job description or were they effected by a change in the relationship between yourself and Mr. Davis in comparison with the relationship you might have had with Mr. Cole?

Colonel HEAVNER. Well, the first part of your question can be answered by saying that there was no change in the job description. It was still an advisory capacity, I am sure, to the Deputy Chief of Staff, Research and Development, and Mr. Davis was appointed on my recommendation and we just had a mutual agreement that we would be a working team and would carry out to the best of our ability.

Mr. MORRIS. Would it be a fair statement to say that, since Mr. Cole left and Mr. Davis has been the technical director up there, that he then has served more or less in an advisory capacity to you and that direct supervision over the operation of the laboratories has been assumed by you rather than the technical director?

Colonel HEAVNER. Well, this is a little confusing to you.

Mr. Davis has not only been an adviser to the Deputy Chief of Staff for Research and Development, but he has been acting as an adviser to the commanding general for the Rome Center as well.

Mr. MORRIS. Who is your superior also?

Colonel HEAVNER. He is my superior, so that there were certain command prerogatives presumably given with this higher echelon of advisory dealing with the commanding general. However, it was still, as I say, a technical advisory capacity and not a line of command that Mr. Davis assumed.

Mr. MCCORMACK. Who gave the divisional authority to Mr. Davis?

Colonel HEAVNER. The job description itself allocated the responsibility, and in the job description I am sure it reads that Mr. Davis is responsible to the commanding general for technical advisory matters and also the Deputy Chief of Staff.

Mr. MCCORMACK. Mr. Cole did not have that.

Colonel HEAVNER. Not to the commanding general.

Mr. MCCORMACK. Who wrote the job description?

Colonel HEAVNER. This was written by the personnel people in conjunction with myself and Mr. Davis.

Mr. MCCORMACK. In other words, you were the instigator?

Colonel HEAVNER. Yes, sir.

Mr. MCCORMACK. And you suggested the commanding general?

Colonel HEAVNER. Yes, sir.

Mr. McCormack. And you are the motivating influence factor in connection with the removal of Mr. Cole?

Colonel Heavner. Yes, sir.

Mr. McCormack. And for which you take responsibility?

Colonel Heavner. Yes, sir.

Mr. McCormack. And the appointment of Mr. Davis?

Colonel Heavner. Yes, sir.

Mr. McCormack. And conferring upon Mr. Davis of additional responsibility to be technical adviser to the commanding general as well as to yourself?

Colonel Heavner. Yes, sir.

Mr. McCormack. To be a technical adviser, doesn't a man have to know what is going on in the various jobs?

Colonel Heavner. That is correct.

Mr. McCormack. Doesn't that mean he has some powers of direction in order to advise you? Wouldn't one think so? He is the top civilian employee?

Coloenl Heavner. Yes.

Mr. McCormack. And in a position of responsibility and trust?

Colonel Heavner. Yes.

Mr. McCormack. And you look to him to advise you on technical matters, is that correct?

Colonel Heavner. Yes.

Mr. McCormack. The general now does, too, both of you?

Colonel Heavner. Yes.

Mr. McCormack. And he just could not sit aloof and without some other powers to perform his responsibility of advising you. Didn't he have to have some other powers of direction to Bureau chiefs?

Colonel Heavner. He does have these powers of direction and he does exercise them. This is done through this technical steering group and also through the laboratory steering meeting once a month in which we sit in session and discuss our program so that Mr. Davis has very intimate knowledge, as well as myself, of the complete programs and the direction of the laboratories.

Mr. McCormack. Suppose some Bureau chief wanted to do something. Who would give him authority to do it? Wouldn't whoever the technical director is have a voice in that?

Colonel Heavner. Yes. He has not just technical advisory work to do. He has technical advise to carry out so he usurps, in effect, some prerogatives, but he doesn't maintain a command prerogative by saying that if I want to promote this fellow, I will initiate the action. This is reserved for the command channels.

Mr. McCormack. You mean promote a man in the armed services?

Colonel Heavner. No, to promote in the civilian category. Mr. Davis has the knowledge of the work of all of the laboratories and is conversant with the people. He does not have any responsibility for signing off job descriptions, promotion forms, in other words.

Mr. McCormack. Does he have the responsibility of passing upon them?

Colonel Heavner. He reviews them. That is part of his technical advisory work so he does get into the operations as well as the advisory work, but he doesn't usurp and take command responsibility.

Mr. McCormack. You had heretofore testified that he was purely an adviser.

Colonel HEAVNER. Yes, but in doing technical advisory work, you are correct in saying that he must go down to the operating level and direct and assist in any way he can.

Mr. MCCORMACK. If there is a dispute between two positions, where would he fit into the picture?

Colonel HEAVNER. If the dispute is technical?

Mr. MCCORMACK. Yes.

Colonel HEAVNER. And he can evaluate it, he does it. If he needs help and wants to have a command decision made, then he can put the burden in my lap.

Mr. MCCORMACK. In other words, he can make a decision or confer with you?

Colonel HEAVNER. Yes.

Mr. MCCORMACK. As a matter of fact, the relationship would be more or less a matter of conference between two persons with an understanding mind?

Colonel HEAVNER. That is correct.

Mr. MORRIS. I think there is one important point I might have failed to bring out here. You did say something about the percentage of time and work which is devoted to "in-house" research versus contract supervision and aiding in the procurement functions of the Army.

Colonel HEAVNER. This is strictly for the Rome Center?

Mr. MORRIS. Yes, and I am speaking of the work done at these division laboratory levels. I think maybe we have the impression that a great deal of the work is "in-house." How much actual research and development work is physically done within these divisions and how much is actually done in private industry or other institutions which is merely supervised from these divisions?

Colonel HEAVNER. The Rome Center has a roughly 10 percent, at a maximum, 15 percent, effort "in-house", the rest of it being in support of our AMC, or contract monitoring.

Mr. MORRIS. And the rest of the work in the division is pretty much working with the people procuring the end items for developing specifications and supervising a pilot production at plants?

Colonel HEAVNER. Or monitoring contract work which is development work.

Mr. MORRIS. Mr. McCormack was speaking of the technical dispute which might arise between division chiefs or possibly within divisions or branches of the laboratory of a division. You were saying, I believe, that these could be resolved by Mr. Davis in cooperation with you, is that correct?

Colonel HEAVNER. Some by himself.

Mr. MCCORMACK. And others he felt he should bring them to you.

Mr. MORRIS. When you say some he could resolve by himself, you mean he could ordinarily resolve by direction over some of the disputes and some in his official capacity he had the authority to resolve. Does Mr. Davis have the authority to resolve disputes without reporting to you?

Colonel HEAVNER. I would say yes for those items which are relatively simple and ones which are of easy technical evaluation. It would be ridiculous to have him running back and forth just about a simple-minded decision. It is not our way of working at all. He does have that allowance and capability. The only problems that

would be relayed to a command standpoint are those that would be of the type that affect a program, that involve policies or high level decisions.

Mr. McCormack. Were you in the same office?

Colonel Heavner. We sit in adjacent offices.

Mr. McCormack. You see each other frequently?

Colonel Heavner. Yes.

Mr. McCormack. So, in the course of an ordinary day, you might say this thing came up today and here is how I decided it, or what do you think of this, like we do in any human conduct.

Colonel Heavner. Yes.

Mr. McCormack. Didn't Mr. Cole do the same thing?

Colonel Heavner. Well, let me say this, in my first approach to the operations, the answer was no. We did not have an intimate dealing like this and, off the record, if I could comment again.

Mr. McCormack. Could we go off the record?

Mr. Lipscomb. Off the record.

(Discussion off the record.)

Mr. Lipscomb. I do not think that I found out the difference in the qualifications of Dr. Cole and Mr. Davis. Did they both have the same qualifications and background and experience?

Colonel Heavner. I would say, roughly speaking, they had the same backgrounds, but from my evaluation and from other people's evaluations, I am sure that Mr. Davis has a higher technical esteem than Mr. Cole. This is probably because Mr. Davis is a little more capable, if you want to put it that way, of keeping current in the state of the art.

Mr. McCormack. You and Mr. Davis get along very well, or did get along?

Colonel Heavner. Yes.

Mr. McCormack. In other words, he never took issue with anything you said to him?

Colonel Heavner. I will not say that. We have taken issue but we have resolved it agreeably.

Mr. McCormack. Where there was a difference of agreement, you did the resolving?

Colonel Heavner. Yes, that is correct.

Mr. McCormack. What about Mr. Cole? In the disagreements between you, did he stick to his point?

Colonel Heavner. The only disagreement that I had with Mr. Cole was about assuming the management of the laboratories and, almost in the very first few weeks, the dissension arose as to the management.

Mr. McCormack. How long was your predecessor there before you arrived?

Colonel Heavner. Two years. He had moved up from Watson as well, and so there was a 3-year carryover.

Mr. McCormack. He was the commanding officer at Watson?

Colonel Heavner. No, he was the director at Watson.

Mr. McCormack. Who was?

Colonel Heavner. Colonel Bennett.

Mr. McCormack. What was his relationship with Mr. Cole at Watson, from a position angle?

Colonel HEAVNER. There were several variations in that so that I am sorry I cannot make it quite clear to you. But the commanding officer had Mr. Cole in positions which were not just the technical director for the director of the laboratories. There had been certain duties involved on top of that, imposed on top of the director.

Mr. MCCORMACK. Was Mr. Cole under or over Colonel Bennett?

Colonel HEAVNER. Under him at times and over him at other times. This is the confusion that I am sorry I cannot tell you all the details on that.

Mr. MCCORMACK. When he went to Rome, he was under Colonel Bennett?

Colonel HEAVNER. Yes.

Mr. MCCORMACK. And they were both there for about 2 years?

Colonel HEAVNER. Yes.

Mr. MCCORMACK. You were not there during that period so you could not tell us except as to hearsay evidence.

Mr. MORRIS. You were saying that shortly before Mr. Cole left, and in fact one of the circumstances which led to his departure, you had talked to him about these meetings he was holding with the scientific civilian personnel, and I assume they were not all civilians, there were probably some military men working there.

Colonel HEAVNER. Correct.

Mr. MORRIS. You stated he had stated to you that several people would leave the laboratories if and when he left. Did in fact any of these people whom he named leave the laboratory? Have they left up to the present time?

Colonel HEAVNER. Yes, sir. If I remember correctly, there were 5 names involved and 2 of them were Mr. Sherman and Mr. Freedman.

Mr. MORRIS. Were they division chiefs?

Colonel HEAVNER. No, they were the joint plans and operations people.

Mr. MORRIS. Staff level people.

Colonel HEAVNER. The chief was Mr. Sherman but it was like a coauthorship in which both of them went around together.

Mr. MORRIS. Associate chiefs?

Colonel HEAVNER. Yes, sir.

Mr. MORRIS. One was head of the plans office and one was head of the operations office?

Colonel HEAVNER. No. They were both doing the chief of the plans work but they worked as a team. Literally speaking, we called them the Gold Dust Twins because they could not go individually but had to go mutually to every meeting.

Mr. MORRIS. Were these men scientists?

Colonel HEAVNER. Yes.

Mr. MORRIS. Did any of the other men leave? I think there were five.

Colonel HEAVNER. The others did not leave. One was Mr. Davis, the other was Mr. Tallman.

Mr. BALWAN. Wasn't there a Mr. Merer?

Colonel HEAVNER. No, he was a projects level individual.

Mr. BALWAN. Did he leave?

Colonel HEAVNER. Yes.

Mr. BALWAN. When did he leave?

Colonel HEAVNER. In the last year.

Mr. MORRIS. Can you remember since Mr. Cole left what had been the nature and turnover of either the chiefs of these divisions or their deputies?

Colonel HEAVNER. Well, since Mr. Cole left and Mr. Sherman and Mr. Freedman, there was only one other chief or assistant chief who left.

Mr. MORRIS. Who was that?

Colonel HEAVNER. Mr. Lader. He was a specialist.

Mr. MORRIS. Was he a chief of one of these divisions?

Colonel HEAVNER. He was an assistant to Mr. Davis in the navigation laboratory. He was a high-level specialist.

Mr. MCCORMACK. How long were you at Rome?

Colonel HEAVNER. Two years.

Mr. MCCORMACK. What is the ordinary tour of duty?

Colonel HEAVNER. This is a hard one to define. I cannot answer that other than to say it is normal general military practice to put in 2 years in 1 location, but what is ordinary as a tour of duty, I do not admit to know myself. I was hoping it would be 3 or 5 years. It is certainly not 5 years. It is closer to 2 years.

Mr. MCCORMACK. What is your opinion on rotation?

Colonel HEAVNER. I think it is a shame to have the frequency of rotation that we have in the services and it is very evident from my own case, and I speak from experience, that when you do stabilize to the extent that you feel like you are doing a job and have some continuity in your work and get to know the people and understand the problems, no sooner does this seem to happen than rotation occurs.

I am going, for instance, to Korea this month and to me it seems a shame. I have no control over these policies.

Mr. BALWAN. What kind of work are you doing today?

Colonel HEAVNER. The tactical control group which is an operational entity. However, it will give me the chance to check on our equipment deficiencies and requirements which may be helpful in the future if I come back to research and development, which I would like to do.

Mr. MCCORMACK. Will you elaborate a little bit more on what you said about rotation. You expressed yourself very directly that you did not view with favor the rotation system which was a 2-year assignment with when a man has had himself adjusted. In connection with research, that is really more important than some other command, some other assignment, isn't it?

Colonel HEAVNER. That is correct.

Mr. MCCORMACK. I wish you would elaborate without my asking you. You understand what I have in mind.

Colonel HEAVNER. I can elaborate by saying that if an officer has a career requirement to get general operational training and broadening factors, mixing up his career by associating with all facets of field life and operational activities, then it might be easy and beneficial to rotate with some frequency such as 3 years. But to take the research and development type of activity where a high specialization is required and where you would prefer and enjoy having continuity in order to get maximum return for the services in your work, I then admit to the fact that it is a shame to move people on a fast turnover rate just to give them operational experience. This, then, takes them out of their field of operation and specialization just to get fieldwork in

order to qualify to increase the career capabilities, and to me this is wasteful if we can agree that a specialty in research and development is possible and can be granted to officers.

Under this system I would say a rotation period once in 5 years would be more realistic and more acceptable, and then I would recommend that they move from a research and development assignment to the research and development assignment rather than to jump into the field and pick up operational experience of the command of troops. That is my reaction to it.

Mr. McCORMACK. I was interested to get your views, Colonel.

Mr. MORRIS. Just one more. You described the operating organization as consisting of four divisions and I think you also stated that, roughly, the works of these divisions on an average on the overall viewpoint could be said to be 50 percent, or one-half, monitoring over outside activities, outside research and development projects in private industry of nonprofit institutions and say, roughly, 2 percent in-house actual research and development; and at Rome the other 30 percent, roughly, would be working——

Colonel HEAVNER. Supporting——

Mr. MORRIS. Supporting the research and development in procurement.

What are the qualifications generally of these chiefs of these operating divisions and what type of man is required for this?

Is this an engineering job? Is it a top scientist job? Or is it a scientific administrative job?

Colonel HEAVNER. Well, most of our requirements at Rome could be best filled by the engineering administrator type of individual, not the high top-level scientist. I feel that in some of our support work, it is possible to get away with just an excellent manager, regardless of his engineering background, if he has good managerial ability and administrative detail.

Mr. MORRIS. Are you talking about the engineering support division?

Colonel HEAVNER. That is right.

For the laboratory levels, we could take an engineering administrator and carry out our responsibilities fairly well with that individual rather than a top-level scientist.

Mr. MORRIS. Can you conceive of any disadvantages of having a top-level scientist as the chief of one of these divisions?

Are the men who are presently chiefs of these divisions scientific administrators or managers, or are they primarily scientists at Rome?

Colonel HEAVNER. This makes it a little difficult because you have me evaluating the individuals now with their capabilities.

The way to answer it in referring to your question would be to say that some of our chiefs—in other words, I can quote them by name if you wish—Mr. Dunn has an engineering background, but he certainly is not a top-level scientist and, therefore, can do a very good job, a very fine job, as an engineering administrator.

Mr. Tallman, who heads the Engineering Support Division, can do a fine job without an engineering degree and he has the capability of managing, so he can certainly carry out his work very well.

Thinking of current organizational structure now, we have Colonel Palmer taking over the directorate, as we call it instead of division,

and he has a master's degree, but does not necessarily have to be a top-flight scientist and can do a fine job of managing the laboratories.

Mr. MORRIS. Can you conceive that possibly a man could be a top-level scientist and a good administrator at the same time and adequately fill the bill, or would his scientific knowledge possibly interfere with his normal administrative duties?

Colonel HEAVNER. The answer to that is that it is always advantageous from where I sit to have the maximum technical background along with your management providing the individual can be a good manager as well as a high-level technical individual.

Mr. MORRIS. Isn't there some necessity for a fair degree of technical competence? Wouldn't it be desirable to have the greatest degree of scientific competence at these division head levels in order that you could not only administer or manage these divisions, but that the top man could possibly contribute his scientific and technical advice to the projects which were going on under him rather than merely administering them?

Colonel HEAVNER. I will answer you by saying that you can use the analyses from industry as well as the Government and prove to yourself that it is sometimes very wasteful to take your high-level, top scientific people and assign them to administrative work.

Think of it this way; it is just as easy to put your top-level scientists in scientific positions and use them for advisory or consultant or specialist work to your engineers who do not need this high-level technical competence to make decisions, and by having this backup of scientific assistance they can do a better job of managing than taking one man and trying to expect him to be a good scientist and a good manager and run the whole show.

Mr. MORRIS. In other words, if there are not the normal strictures of an organization which dictate that the chief of an organization shall be higher paid than most of his subordinates, it might be a good arrangement to have an administrator at the head of one of those divisions and a man better qualified scientifically or several men better qualified scientifically, actually working on the project within the division, possibly even higher paid than the chief; and the chief would be an administrator and the scientists would work and contribute their scientific background to the work in process rather than to the administration.

Colonel HEAVNER. That is correct.

That is one of the headaches and the heartaches of a civil-service system which forces us to consider ratings along with positions.

There is a special allowance. The title is called specialist whereby you can actually pay a high-level technical man as a specialist more than the administrative chiefs, but it gives us a very difficult task to do it.

Mr. MORRIS. Can you conceive that there can be some possible difficulties in that the chief of the division who has been in this type of a situation, this hypothetical situation, to be an administrator might be put in the position of resolving technical conflicts between 2 or 3 people in his division who have higher technical competence than he does as the chief?

Colonel HEAVNER. I would think this would be a very rare occurrence of minimum possibility that it is certainly not worth worrying about.

Mr. MORRIS. Do you have the situation at Rome where some of the men in the divisions at the working level are of higher technical competence than any of the chiefs?

Colonel HEAVNER. Yes, I am sure this is so. Technically speaking, this is so. But not managerially.

Mr. MORRIS. That is all I have.

Mr. LIPSCOMB. Do you have any other questions, Mr. McCormack.

Mr. MCCORMACK. No further questions.

Mr. LIPSCOMB. Mr. Balwan, do you have any other questions?

Mr. BALWAN. No further questions.

Mr. LIPSCOMB. We certainly appreciate your coming here and wish you the best of luck on your tour of duty, Colonel.

Colonel HEAVNER. Thank you.

Mr. LIPSCOMB. If there is no further business to come before the committee, we will adjourn until Monday morning at 10 a. m. in room 1501.

(Whereupon, at 5:10 p. m., the subcommittee adjourned to Monday, June 14, 1954, at 10 a. m. in room 1501.)

ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

MONDAY, JUNE 14, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON MILITARY OPERATIONS OF THE
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met at 10:19 a. m. in room 1501, New House Office Building, Hon. R. Walter Riehlman (chairman of the subcommittee) presiding.

Mr. RIEHLMAN. The subcommittee will come to order.

Let the record show that Mr. Ikard and Mr. Riehlman are present. Mr. McCormack is anticipated very shortly and Mr. Lantaff is on his way to the subcommittee.

We have this morning as a witness Mr. Ralph I. Cole, who for some time was connected with the Rome Air Development Center at Rome, N. Y. He resigned his position some time ago, and the committee is deeply interested in the reason for his resigning and any constructive information he can give the committee with respect to the program at Rome and the manner in which the differences could be straightened out and a better program carried on.

Mr. Cole, do you have some statements that you would like to make directly to the committee or would you feel better if our staff director, Mr. Balwan, interrogate you about the different activities?

STATEMENT OF RALPH I. COLE, FORMERLY TECHNICAL DIRECTOR OF ROME (N. Y.) AIR DEVELOPMENT CENTER [1]

Mr. COLE. I think that might be better to get to the heart of the activities.

Mr. RIEHLMAN. Would you first, for the record, give us your background experience in this field of activity, Mr. Cole?

Mr. COLE. Surely. I hold a B. S. degree from Washington University, St. Louis, Mo., and, in 1936, a master's degree from Rutgers, in physics.

I first entered Government service in February 1929 in the research and development field and went to work at Fort Monmouth. I remained a civilian in the Signal Corps until June of 1942 when I was directly commissioned a major.

My duties did not change very much on entering military service and at this particular moment I was Chief of the Radio Direction Finding Branch of the so-called Eatontown Signal Laboratory, which group had, to the best of my knowledge, some 500 engineers and

NOTE.—Asterisks denote classified material deleted.

[1] With the chairman's permission, certain portions of Mr. Cole's testimony regarding confidential personal matters have been deleted from the printed hearings. The deleted matters are indicated by asterisks.

scientists. This group was built up by me at the start of 1941, a little before Pearl Harbor, and my taking over merely as a military man filled a void on a paper chart. It did not change the duties.

All during the war I was my own chief engineer. In July of 1944 I was promoted to lieutenant colonel and transferred to the staff of the commanding officer of what is now the Signal Corps Engineering Laboratory. In January 1945 I was named to be the officer to turn over the Eatontown Signal Laboratory to the Air Force in fulfillment of an arrangement whereby the Air Force, on February 1, 1945, were to take over their own research and development.

Subsequently, on the 1st of February 1945, I also was transferred to the Air Force from the Signal Corps and with Col. O. C. Maier, who is no longer on active duty and is now the director of research for Pullman. The two of us organized the Watson Laboratories, named after Lt. Col. Paul Watson, who was my associate for many years, who died during the war.

The problem of organizing Watson Laboratories was to accept transferees from the Signal Corps in small groups of people and integrate them—there was still a war to be won—to integrate them quickly and put the Air Force into the electronics research and development business and keep production going at the same time. This we did in reasonable course of time. We ended up with Watson Laboratories by the time we were moving—the fall of 1950 when we started moving—of perhaps 1,200 people, over half of whom were engaged in scientific research and development.

The projects handled concerned the ground electronics efforts of the Air Force and all the air defense and the tactical air research and development effort. In addition all the communications from the ground to the air—the air to the ground being handled by Wright Field—all the countermeasures on the ground as opposed to countermeasures in the air.

This was at a time when the Air Force was initiating the conversion of all the communications channels over to UHF (ultra high frequency). Until they could get their laboratory going, this put the Air Force at quite a disadvantage, but by 1946 we had Watson Laboratories running pretty well and by that time there was not a war on either.

The start of Watson Laboratories (the Eatontown Laboratory) was in one respect poorly planned in that it was never intended that Watson be a permanent installation at that location and the buildings in turn were in effect merely loaned to the Air Force until they could find a permanent home.

Mr. BALWAN. Loaned by whom?

Mr. COLE. By the Signal Corps. These were the same buildings that we occupied that were renamed and called the Watson Laboratories.

The situation at Watson Laboratories was such that the morale was very high, despite the fact that on almost a yearly basis, if not oftener, there were rumors of an actual or an impending move. This seriously concerned all of us.

I might say, though, that in April of 1947 I went off active duty, relinquished the military part of my position, and took on the civilian part of it, which I had been carrying on all the time anyway. I never, on active duty, had a civilian chief engineer or civilian technical director.

I found that this rumor of impending move was a very serious matter and, from time to time, the move to Rome was being considered.

At the very beginning the move to Rome had a lot of attractive features. It has the feature that here was an airbase practically empty. There were some 1,200 people there at the start of the serious talk in 1948–49. There was plenty of housing available at both Utica and Rome, and it looked like it was an opportunity to occupy some permanent buildings at a very nominal cost and to have an airfield which most of us felt we needed in order to conduct the Air Force responsibilities.

We were always making tests with the aircraft in conjunction with GCA landings and other similar work.

By the time this move was actually ordered, Korea had intervened and the situation was somewhat different, to say the least. There were several things that transpired at that time that, for the record, maybe ought to be entered.

First of all, when the move to Rome was actually ordered in the fall of 1950 (about November), there was a different situation than that which had been planned, the Korean war having caused quite a bit of mobilization, making housing scarce and causing the space for laboratories to be used up which was, from the overall standpoint, even more important than the space for housing. Some housing of an emergency nature is always available.

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We had a civilian organization at Rome and I was the civilian technical director and all technical personnel reported to me.

Mr. McCormack. Who was the commanding officer when you were there?

Mr. Cole. Colonel Pachynski, now General Pachynski. He was the commanding officer of the element of which I was a member.

Actually, there was a Colonel Burroughs who was the base commander but we had nothing to do with him.

Mr. McCormack. Watson included the command force itself when you first went there?

Mr. Cole. I don't know how to interpret that.

Mr. McCormack. It was the laboratory.

Mr. Cole. The support as well. In moving to Rome, in effect what we did was to move officially as an organic organization but physically we moved only the engineering element. Other people moved to augment the existing force and fill gaps. We used the maintenance department on the base and the personnel department on the base. Outside of engineering, the only other organic element that we brought there was a laboratory procurement division.

Mr. McCormack. I meant that the base included the laboratory and other activities, did it not?

Mr. Cole. At the moment, until the founding of the ARDC, we were only a tenant. Colonel Burroughs commanded the base and we were a tenant on the Griffiss Air Force Base and we were known as the 3151st Electronics Research and Development Group.

Mr. McCormack. At some time while you were there, were the commands separated?

Mr. Cole. Yes; with the activation of the ARDC, things changed just exactly around. The Rome Air Development Center super-

seded and abolished the base command and also produced an Electronics Division of which I was the technical director.

Mr. McCormack. Who was in command of the reorganization, when the reorganization took place? Who was the military commander?

Mr. Cole. I am trying to remember whether anybody came there before General Doubleday. I believe that is who it was.

Mr. McCormack. What is the name of the one in command there now; the officer?

Mr. Cole. Doubleday just left to go overseas.

Mr. McCormack. What is the name of Doubleday again?

Mr. Cole. I think it is D. B. Doubleday, a brigadier general.

Mr. Riehlman. The one Mr. McCormack was talking about is the man in charge at Rome now; the officer.

Mr. Cole. Brig. Gen. Stewart Wright.

Mr. Riehlman. Who is this colonel?

Mr. Cole. The man who was here the other day?

Mr. Balwan. That is Colonel Heavner.

Mr. McCormack. Who was his predecessor?

Mr. Cole. Colonel Joe Bennett. What happened is that at Watson Laboratories we had a commanding officer, we had a military head of the electronics effort of which, until 1947, I was both the military and civilian head, and we had a civilian technical director.

When we became the 3151st Electronic Research and Development Unit, we really had two people occupying the same position, namely, that of commanding officer of Watson Laboratories, Colonel Pachynski no longer had a command in the sense of the word, since he was marking time waiting for the Air Research and Development Command to get started. So, in reality, for a while there we had really two officers, Colonel Pachynski and Colonel Bennett, and so we adopted a different organization than we had at Watson.

We adopted a Director of Electronic Development and a Deputy Director. Colonel Bennett was the Deputy Director. Colonel Pachynski was the Director, and that is how it was that they took care of the military situation.

Mr. Balwan. Might I straighten out one point here?

Prior to the founding of the ARDC, under what command was research and development?

Mr. Cole. The Air Materiel Command at Wright Field. We reported to the Air Materiel Command commanding general.

Mr. Balwan. When Griffiss Air Force Base was activated, it was activated as the Air Materiel Command base?

Mr. Cole. Yes.

Mr. Balwan. Air Materiel Command having the function of being the supply organization.

Mr. Cole. As well as research and development.

Mr. Balwan. At that time, yes, so Griffiss Air Force Base, even today, is a large supply depot and there were two missions up there when you went up there. One was to be a supply depot for the base as well as for an electronics division up there.

Mr. Cole. Yes. I might clarify this by saying that with the activation of the Research and Development Command in Baltimore, and with the almost immediate activation of the Rome Air Development Center in May of 1951, the responsibilities were as follows: You

had still the Air Materiel Command operating a depot at Rome as a tenant organization. The command function had been reversed and at the Rome Air Force Center, the commanding general was doing all the housekeeping as well as to run the Electronics Research and Development and the Special Test Flight Squadron.

Mr. BALWAN. In 1951, they took over the command of the old base when ARDC was formed? They provided the support as well as running the laboratories?

Mr. COLE. Yes.

Mr. BALWAN. And I understand that now Air Materiel Command is going to come in and take the base over again.

Mr. COLE. So I understand.

Mr. BALWAN. Proceed from that point.

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Mr. BALWAN. Was there an officer's club on the base?

Mr. COLE. Yes. For 10 years I have been a colonel in the Air Force and Signal Corps Reserve, and I had been a full member of the officer's club at Fort Monmouth and accorded every privilege possible to accord. I moved up on the base without my wife and children, leaving them at Long Branch, N. J., and naturally I asked for and received a room at the officers' club where I had stayed many times before on 1-day visits up there.

I went away then on a trip, and when I came back the second day I was invited to resign from the officers' club for the reason that there were no longer to be any civilians possible to have officer club privileges, and whether you were a Reserve officer did not count.

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Then when Heavner came back (the time he came back from school and had used some leave) it was than about April of 1952, when he came and I think you already have the incidents recorded but if you want them from me I will be glad to do it.

Mr. BALWAN. I wish you would relate the incidents.

Mr. COLE. Essentially, it is as follows:

The day that Colonel Heavner returned, as far as my echelon was concerned, was the day of a Scientific Advisory Council meeting at the Rome Air Development Center.

Mr. MCCORMACK. How many were present at that meeting, about?

Mr. COLE. I wouldn't know. These staff meetings would have anywhere from 20 to 50 people. I don't know whether the number was important or not. I was only at this particular meeting long enough to get started, to ask a few questions, and I excused myself, and there might have been some stragglers who came in afterward.

What these meetings were for, and the point is a little in dispute, I found that with a large organization, with a large number of staff and a large number of project engineers, that in order to keep our due dates and not have an excuse for not getting proper matters done on time, and asking for extensions, it was necessary, periodically, to go over every commitment that had been made. If any commitments were not being fulfilled, the object was to find out what was the trouble and to have the plans and operations staffs hear all this, the operations being in charge of the procurement and the plans in charge of the budget programs. This enabled the crossfire to take place between the plans people and the operations people as well as the actual project engineers.

No one of less stature than a project engineer usually attended this meeting. There were hundreds of people not invited to these meetings. This is the way we operated, meeting with the individual laboratory key people and my key staff. There were about eight laboratories at the time, all of which did not have meetings.

For instance, we had a laboratory on environment testing. This laboratory had to integrate their testing program, and a representative of that laboratory had to be there at each of the four or five meetings of laboratories that we had a week. He might not have written anything down on a piece of paper. We minimized the paperwork and there might be only the most terse note on it. That was rather than to have somebody write a book about it and then somebody else would have to glean it.

The report on a project was one line or so and if you cannot say it in that length you should not say it at all. We found it an excellent way for project men to learn how the whole organism at Rome operated and when they went on a trip and saw something interesting, they would report it to everybody.

Those meetings lasted from 30 to 40 or 50 minutes.

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Mr. BALWAN. Would you consider yourself a scientist, Mr. Cole?

Mr. COLE. No, I wouldn't.

Mr. BALWAN. How would you classify yourself?

Mr. COLE. I would say an engineering manager.

Mr. BALWAN. Does the kind of work you do require the same climate that the scientific people require?

Mr. COLE. Oh, yes. I have, as you know, a master's degree in physics. I have taken a lot of courses but I do not consider myself a scientist. I am more interested in people, the climate, the environments, and in the planning function than I am in the scientific thing, though.

Mr. BALWAN. The military people tell us there is a difference in the kind of climate you have to provide. It depends on whether you have more of a basic research program than a development program and the more you deal with engineers the less freedom is required on the development side.

Mr. COLE. Unfortunately, civil service terminology doesn't always bring out the things in the true scientific sense. There is a rating called electronic scientist which probably——

Mr. BALWAN. What rating did you have?

Mr. COLE. "Electronic engineer," because I insisted on retaining the status. I really believe that everyone is not a scientist. My own philosophy on this is that one is not a scientist by decree.

For instance, doing the type of work that requires a scientist. I would be willing to say that there is not one man out of 50 at Rome who should be called that. For that matter, certainly there are many, many men called electronic scientists who are probably very good engineers. I think an engineer is a man who has the vision to place a scientific finding into practical usage. A scientist is seeking new facts. He is not equipment-minded.

Mr. BALWAN. And your people are equipment-minded?

Mr. COLE. Yes, at Rome.

Mr. BALWAN. Those people are creators and require some of the same type of climate that exists at universities, would you say?

Mr. COLE. Well, my university experience is somewhat limited. I would say from my traveling around to places like the Willow Run Research Center, that our climate at Rome, from the civilian control on down, differs very much. We tried to maintain that sort of environment, though. At one time we had the University of Syracuse giving some 13 courses and we got some $70,000 appropriated from the Air Force, at my insistence, and we tried to do everything possible to create a scientific atmosphere.

I would not want to say that this operation of this laboratory at Rome should be any different than, say, at the General Electric's electronics park.

Mr. BALWAN. Are you credited with any inventions or patents?

Mr. COLE. Yes; I am.

Mr. BALWAN. Could you describe some?

Mr. COLE. It has been many years but I think one of the most recent patents—and I have not been engaged in engineering in about 12 years, but my most recent patent was on a system of direction finding that we used during the war to obtain a greatly increased accuracy of bearing. We produced some 30 or 40 of them.

Apart from inventions, I am the designer of 3 or 4 radio receivers used in tanks and one was produced in about 50,000 lots during the war, known as the BC–312 receiver and a tank transmitter was my idea. I was the designer.

But as far as patents, I believe I hold 4 or 5 patents.

Mr. RIEHLMAN. Mr. Lantaff, do you have some questions?

Mr. LANTAFF. The only question that I have is with reference to your course that is given by the Department of Defense at the University of Chicago.

Mr. COLE. Yes.

Mr. LANTAFF. In management.

Mr. COLE. Yes.

Mr. LANTAFF. Based on your experience, can you give us your evaluation of the worth of that course to the officers connected with this research and development?

Mr. COLE. You appreciate I have not taken that particular course. I have taken courses at New York University that have somewhat the same tinge as this one.

Mr. LANTAFF. I was not speaking so much of that course itself but whether or not officers trained in courses of that type were better in this research and development work than those who had not been trained, or whether it boiled itself down as in Colonel Heavner's place, to one of leadership and personality.

Mr. COLE. I would value leadership and personality above all the academic managerial courses that could be taken and I would want to state that the opportunity is there to train people a good deal faster. They can get it in a formal sense, in a formal course at the University of Chicago. I can see no detrimental concept. I think it is is a worthwhile field.

I would like to comment further on this education of officers business.

One-half of your life as an officer, you seem to be going to school. This is fine if one is not in a direct chain of administrative command and if these people are used as consultants.

It would seem to me that the Department of Defense system of educating officers in fields like this is what is leading to friction due

to the fact that a person might feel—personality being what it is—a person might feel that he is somewhat superior. If he exhibits that particular tendency, that can be a very dangerous thing.

On the other hand, I would rather evaluate people not by the color of the suit they wear but by the individual.

* * * * * * *

Mr. LANTAFF. I was about to ask you for that. We have precedent for that, that upon being detailed to certain types of operations like the CIA, no uniform is worn. Do you think it would be healthier for research and development if officers detailed to that organization were shorn of their military clothes and worked in civvies?

* * * * * * *

Mr. COLE. Yes.

Mr. LANTAFF. And that in that type of work where you are working with civilians that you should have a different type of report?

* * * * * * *

Mr. COLE. I think the present system of dual management has got to be done away with. I think that you should not have this system at a laboratory. I do not say that there are not places where you do not need this, but the laboratory does not need to have a civilian chief and a military chief and, if you would settle on one or the other and strip him of his suit of clothes, it would work too.

A man commands troops for 3 years and is in Korea and then he comes back to the United States and is assigned to a laboratory and he doesn't know how to deal with the laboratory and with the people in it. And the same thing goes for a man who has been in a laboratory for a certain number of years when he is suddenly shifted to a place like Korea, during the war, for instance. He doesn't know how to deal with the troops there. It is very difficult there. You cannot expect a man to be a crackerjack fighter pilot and the next instant be the most diplomatic person in handling civilians and the most competent engineer. It is expecting an awful lot of a man.

Mr. LANTAFF. The military man has not only the command responsibility but the financial responsibility placed on him and I can well imagine that in discharging that accountability and that budgetary responsibility that if you took away from the officer and the military all their powers and prerogatives they would be given the responsibility without the necessary prerogatives that go with it to carry it out in discharging that responsibility.

Mr. COLE. Let us discuss accountability, for instance.

This is probably costing the American taxpayers more than this other thing. Now, at Rome we had $5 million worth of equipment.

Now, let us look at Watson Laboratory. One-half of the people at Watson were engaged in housekeeping and of that one-half, half of those were engaged in keeping the supply account. The payroll was $3 million a year, so we are spending $750,000 a year to keep accountability. Why, you would not have that much stolen in a year if you left the warehouse doors open.

Let us discuss this responsibility a good deal more. Nobody can convince me that when I would sign my name with a colonel in front of it a person would think that that was any better document than when I signed it as a civilian, and I have signed it both ways. It

merely means that you want to make certain people assume certain responsibility. I believe that if you cannot find the man to discharge the responsibility, fire that man.

Right now, I am afraid in our system we are breeding mediocrity, not competence. We are not giving the men of competence enough responsibility. Every time they put a signature down, there is somebody else's signature, even though it is a lieutenant. As result, there is a good deal of this type of thing which I have had happen to me and I am sure you must have heard of some of it, where I have signed my initials or have put down my signature and somebody else had neglected to read the document or had neglected to sign the document and they would be asked about it and they would say, "Well, Ralph, I did not think it necessary to read it. We know you will read it."

So we have a lot of useless signatures in between. I think this responsibility should be given to one person because in industry we tell somebody that if he signs, nobody else does it.

Mr. LANTAFF. In other words, your recommendation would be that if $100,000 is allocated, budgetwise, to a particular project, that project engineer should have the responsibility of developing that project, keeping that project within the budget figures and, if he did not, they would get rid of him.

Mr. COLE. Providing that you had some look-sees in between. If the boss man looked at this every week and had a prescribed time. I have always found that the best of intentions could go wrong. If you merely say you will look at it sometime that is one thing, but if you say that at 9 o'clock tomorrow morning you will look at it, you have that type of surveillance that is necessary. The additional paper necessary in the chain of command to provide that is a lot of bunk.

Mr. RIEHLMAN. You were at Watson Laboratories and when you were you were a colonel?

Mr. COLE. Until 1947, April.

Mr. RIEHLMAN. You were holding at that time the same position that Colonel Heavner is holding at Rome at this time. Am I correct in my observation on that?

Mr. COLE. I am trying to think of one thing. There is one difference right now in Colonel Heavner's position. I believe he activated one more unit, namely, the Reconnaissance Laboratory.

Mr. RIEHLMAN. At Watson you were directly in charge of the whole program, is that right?

Mr. COLE. Let us put it this way; Watson Laboratories had a commanding officer who reported to the commanding general of the Air Materiel Command. Watson Laboratories and a Chief, Engineering Division, myself, who reported to General Rives at Wright Field, so Colonel Maier's correspondence went to the commanding general of the Air Materiel Command and Colonel Maier did not say, "Route your correspondence to me." My correspondence went directly to General Rives.

Mr. RIEHLMAN. But you did not have a technical director under you?

Mr. COLE. No, I was my own technical director.

Mr. RIEHLMAN. It appears to me, and I did not hear the colonel testify on Friday, but it appears to me that the colonel feels that he is

well enough equipped to carry out the command at Rome the same as you carried it out at Rome.

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Mr. RIEHLMAN. He will be taking some direction from Baltimore.

* * * * * * *

Mr. COLE. I do not think there is enough thought given to the organization of this course. I was never a candidate to take the course. It came into being about 1950. It was first offered in New York University which pioneers a good deal in this work. I have taken courses in their management research in about 1948, as these courses were given. They can be given and I think that one certainly has to be careful who you allow to take them and what value you place on the course he takes and the information he comes back with.

Mr. LANTAFF. I would like to be sure this is in the record. Would you mind listing the men who left the research center as a result of this situation and, just very briefly, who they are? I don't mean personally but I mean what they did and what their value was.

Mr. COLE. In chronological order, these people I speak of left between the end of June and the 1st of September of 1952. I personally left on the 7th of July.

* * * * * * *

Mr. LANTAFF. Let me ask you a question right at that point that comes to my mind: These scientists left to go to Lincoln Laboratories, and that, as I understand it, is a contract relationship?

Mr. COLE. That is right.

Mr. LANTAFF. With the Government?

Mr. COLE. Yes.

Mr. LANTAFF. Do you think that this research and development would progress farther if all of this research and development work was handled on a contract basis, with officers detailed to those laboratories in noncommand positions, but to work in partnership, so to speak, with the civilian scientists?

* * * * * * *

Mr. COLE. So, we had a very good feeling of respect with the universities up in that area, and Syracuse especially was cooperative. Dean Galbrath is a very personal friend of mine.

Actually, I suppose we got more than our money's worth from Syracuse, as well as some of the other universities in the Mohawk Valley.

There is a situation up in that country, you know. There is, in my opinion, a great potentiality for science up there that is untapped.

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Mr. LANTAFF. Incidentally, Mr. Chairman, do we have an analysis of the personnel turnover at the various installations?

Mr. RIEHLMAN. We have tried to get from the witnesses from time to time information regarding the turnover at Cambridge.

Would you like that information at Rome?

Mr. LANTAFF. I just think it might be helpful. We are getting back again to this question of efficiency reports, and I am thinking there that one way to reflect on whether or not an officer is getting along with the scientist and whether or not he is exercising command responsibility in the proper way is to look at the actual statistics of personnel turnover.

Mr. COLE. Of course, there is such a thing as turnover plus dissatisfaction of present employees. In other words, are the present people contemplating leaving?

Right now industry, having slackened up a bit, is holding people in installations like Rome, just waiting the opportunity. Then they will go.

Mr. RIEHLMAN. I might say this in response to your question: that when Secretary Quarles was before the committee we asked him that question and he said about 15 percent, but that was across-the-board. We have asked him to give us the information as to the percentage in the top echelon of the scientists in the country, and he is going to get that information for us for the record.

Mr. BALWAN. Mr. Lantaff, may I give Mr. Gardner's answer to this?

He didn't give this orally because we didn't finish with him, but he left the answers in a statement.

We stated this problem: "Civilian scientists are leaving military R and D in a general exodus."

The Air Force replied:

> The best available figures do not support the contention that large numbers of technical and scientific employees are leaving the Air Force because of dissatisfaction with working conditions and military-civilian relationships. Actually, the rate of loss of scientific and technical personnel in ARDC, 15.7 per 100 employees annually, is roughly the same as that in private industry——

Mr. COLE. No; that isn't true.

Mr. BALWAN (continuing):

> nonprofit research organizations and NACA, and has decreased in the last year. Attachment I indicates the specific figures in this regard.
>
> When it is considered that private industry consistently pays better salaries, and manpower and budget fluctuations cause Government employment to be somewhat unstable, it is surprising that turnover among scientific and technical personnel is as low as it is. It should also be pointed out that a study conducted recently by BLS (Bureau of Labor Statistics) revealed that, contrary to general opinion, technical and scientific personnel are an exceptionally mobile group, shifting readily from one type of employer to another and to different parts of the country.
>
> In spite of the favorable comparison in loss rates indicated above, the reasons as to why our scientists leave is still of major concern. A study was made at Wright Air Development Center, which has approximately half of this type of personnel in ARDC. A tabulation of the results is indicated in attachment 2. The study covers a period from November 1, 1952, through October 31, 1953. It will be noted that only 5.3 percent gave dissatisfaction with working conditions as their reasons for leaving. Although military domination and supervision may have been a factor in some of the 12.3 percent cases where no reason was given, it should be noted that in no case was this reported as a specific reason.

We had talked about this figure, 15 percent, which Dr. Quarles gave us in the presentation of the Secretary of Defense level, and discussed this point, that 15 percent may be true of all the scientists, including the P–3's, down to the GS–9's, but we were concerned with their top brains, the people who held the Public Law 313 jobs, the supergrades, plus maybe the 14, 15, and 16, and Dr. Quarles had indicated he would try to provide us with an analysis.

Mr. LANTAFF. By laboratory?

Mr. BALWAN. Not by laboratories; overall.

Mr. RIEHLMAN. Overall.

Mr. BALWAN. But we should ask, probably, Mr. Gardner to give us that information, if he testifies again.

Mr. RIEHLMAN. I think that is a good idea.

Mr. MCCORMACK. I think you ought to have him back. There are more questions I want to ask him.

Mr. IKARD. Me, too.

Mr. LANTAFF. Do you have any comment on that, Mr. Cole, that statement?

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Mr. RIEHLMAN. We have been much interested in what has been developing and probably will continue to develop in this research and development program with respect to military versus civilian scientists, and we have asked the different witnesses if they would be willing, in their own words and in their own opinions, to give this committee whatever advice they can in respect to some program that could be set up to bring about a better working condition in this field of research and development.

Now, that is a pretty big question and I wouldn't want it answered on the spur of the moment.

We would much prefer, the same as we have asked the other witnesses, to have you think this over and to give it to us in writing, if you would.

Would you be willing to do that, sir?

Mr. COLE. Yes, sir; I would.

I was just thinking that probably most of my comments are in print already. I have written——

Mr. RIEHLMAN. Well——

Mr. COLE. There is a list of publications there.

Mr. RIEHLMAN. That is true. We have those.

Mr. BALWAN. I think the chairman had something in addition to this. These are responses to certain problems and questions which the subcommittee had in mind in going into this project, and I believe I am expressing the chairman's question correctly if I state what we are trying to get is to find out if some policies can be set up which would assure greater stability in the relationship between military people and civilians. For instance, you explained one thing. We get a man like General Doubleday in and things really go downhill from your point of view, and another man comes in like General Wright, and things look up, and it just keeps going on like that.

Mr. COLE. That is right.

Mr. BALWAN. Can we set up some system which would assure more stability or regulations—I don't want to use the word "regulations"—or policies of some kind?

Mr. RIEHLMAN. A better word would be "policies"—policies and programs to be instituted.

Mr. BALWAN. Yes.

Mr. COLE. Well, I will certainly help all I can.

What I meant wasn't just what I gave you there. This is a list of publications on that other thing.

Mr. RIEHLMAN. I am sorry.

Mr. COLE. You will find this is in print. In reference at the Library of Congress, you will find 4 or 5 publications that are in this field. I have several that are unpublished. I am in the process of writing some more, but you will find these convey pretty well everything I have said here today. I will deliver a speech tomorrow night

at the Franklin Institute in Philadelphia on "The Influence of Environment in Engineering Careers," and I will be very happy to see that you get a copy of that.

Mr. RIEHLMAN. I think it would be better, Mr. Cole, if you would let me interrupt you at that point, if you could take from these different publications certain portions that you feel would tie in with our request for information.

Mr. COLE. All right.

Mr. RIEHLMAN. So that it would be more in the form of a digest, if possible, and then we could insert it in our record.

Mr. LANTAFF. Mr. Chairman.

Mr. RIEHLMAN. Yes.

Mr. LANTAFF. In other words, if Mr. Cole was free to sit down with the Secretary of Defense, Mr. Wilson, and in response to a question of Mr. Wilson, "Well, now, what can I do to straighten out this problem in research and development?", what would you tell him; what would you recommend to do?

I think that is what the chairman is asking.

Mr. RIEHLMAN. That is about what we are after, and that is in very understandable language.

Mr. COLE. How much time does one have to get this together? When do you need this?

Mr. RIEHLMAN. We would like it as soon as we can get it because we want to complete the hearings in probably another 10 days and have a report right on its way.

Mr. BALWAN. Would 10 days be rushing you too much on something like this?

Mr. COLE. Well, let me look into this and give you a phone call.

Mr. RIEHLMAN. All right.

Mr. COLE. As to just what I can do.

Mr. LANTAFF. In other words, Mr. Cole, we are in a position where we, after all these hearings, want to see if we can make certain recommendations.

Mr. RIEHLMAN. That is right.

Mr. LANTAFF. And, to that end, we would like the advice and recommendations of those whom we feel to be experts in the field.

Mr. COLE. What would you like this called? Just "Recommendations for Research and Development Organizations"?

Mr. RIEHLMAN. I think that might be a fair title, or "Recommendations for a Better Working——"

Mr. BALWAN. "Recommendations for Improving Air Force Policy in the——"

Mr. COLE. I would like to leave out "Air Force."

Mr. LANTAFF. Yes. I would make it——

Mr. RIEHLMAN. I would leave the Air Force alone.

Mr. LANTAFF. I would put it "Defense."

Mr. RIEHLMAN. That is right.

Mr. LANTAFF. "Department of Defense Policies in the Field of Research and Development."

Mr. RIEHLMAN. Yes. That is what I would think.

Mr. COLE. Relating to research and development?

Mr. RIEHLMAN. That is right.

Mr. COLE. Let me see what I can do. I will phone you in the next couple days. I will be in Philadelphia tomorrow.

(The requested material is as follows:)

RECOMMENDATIONS FOR IMPROVING THE DEPARTMENT OF DEFENSE ADMINISTRATIVE POLICIES RELATING TO RESEARCH AND DEVELOPMENT

1. In the strictly military command organizations separate the command function from administration of scientific research and development projects. This can be accomplished in any one of several ways, viz:

(*a*) Place a "civilian" in top command in much the same manner as the function of the Secretaries of the Army, Navy, Air Force, etc. Thus, the military chain would be subordinate to the civilian and there would not be the tendency on the part of the military to bypass those civilians under their administration in the formulation of policies, procedures, etc. This method of approach has the added advantage that the present major research and development centers are left intact except for the new civilian chief. By interweaving civilian lines of control with that of the military at lower echelons, one gains the following advantages:

(1) More permanency in lines of control.

(2) A higher "court" for the civilian executives at a research and development center to appeal to in the advent of need.

(3) The inability to superimpose military regulations unless approved by the top civilian chief, to whom all civilian and military members of the center report.

(4) The tendency for the military to moderate their "superior" feelings toward the civilians.

(5) Early recognition for those military officers who are capable of evoluting into top rank administrators of scientists with the possible added advantage that these officers so spotted may then be given "engineering duty only."

(*b*) Establish a completely separate civilian organization with participation of military officers on the following basis:

(1) Assign military officers in a liaison capacity to each element of the organization where military tactical knowledge is essential in carrying out the work. These officers, serving in a staff capacity speak for their service but are not in the military channel of control of the research and development organization to which assigned. Furthermore it is recommended that these officers wear civilian clothes rather than a uniform.

(2) Treat the military responsibility for carrying out research and development in much the same relationship of contracting officer-contractor wherein the requirements are set forth and the civilian organization takes full responsibility in performing under a "contract." It should make little difference that the facility happened to be a Government civilian facility.

2. Make maximum use of industrial engineering management know-how in the following manner:

(*a*) There exists in industry a tremendous pool of accumulated knowledge which can be quickly focused on any problem without the necessity to recruit new permanent staffs expressly for this purpose. Furthermore the project may be a relatively short-term one and the permanent civil-service staff may be soon excess to needs.

(*b*) Industrial facilities already in existence ofttimes can be diverted to solve the existing problem without the necessity of large capital expenditures on the part of the United States Government.

(*c*) A large degree of added flexibility also is achievable by being able to utilize industrial engineering management consultants working hand in hand with the existing Government facility, ready to offer advice and services where and when it is needed. Among the many services which can be rendered are the following:

(1) Assistance in recruitment of permanent staffs.
(2) Advice on organizational procedures.
(3) Weapons systems evaluation.
(4) Feasibility studies.
(5) Preparation of specifications.
(6) Project management.

Mr. RIEHLMAN. I would like permission at this time to insert in the record the questions and answers that were presented to Mr. Cole by this committee and also a description of his work and background and experiences and publications that he has written in respect to research and development.

(The data referred to is as follows:)

REPORTED PROBLEMS IN MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

Development programs

I. Civilian scientists in military research and development centers are reported to be generally dissatisfied with military domination and administration.

(*a*) This is believed true of the top civilian scientists. Those in the lower echelons are not greatly affected since they do not of necessity come into close contact with the military command.

(*b*) The above dissatisfaction arises from sources as follows:

(1) Rapid turnover of military heads causes upheavals of personnel, particularly when the new commander decides a reorganization is absolutely necessary. Thus, the top civilian jobs are frequently abolished due to a purely military command decision with no recourse on the part of the civilian except to bump the man below him and take off an inferior position.

(2) The two-head system of the military, namely, to have a key civilian share an office with the military head and be responsible for purely technical matters, requires the civilian to take orders from the military, even in those fields of activity where there has been no prior preparation on the part of the officer concerned.

(3) A military officer in a Government laboratory is rated for his performance as an officer and his efficiency record is not based upon his qualifications as a scientist or engineer. Too often an officer is sent to a school and mere passing of the course entitles him to be awarded that military speciality number, corresponding to such titles as research director, research administrator, etc. Subsequent assignment to a position where he deals with key experienced civilians puts this officer in a position where he performs his duties by command rather than by knowledge. The military should learn that mere placing a uniform on a man does not change his technical stature.

II. Civilian scientists are leaving military research and development centers in a general exodus.

(*a*) There is hardly a general exodus, but the condition is a serious one. The top keymen are particularly concerned.

III. When a military organization is imposed on a research and development program there is a tendency for the military to expand its control over technical decisions and operations in the research labs.

(*a*) This is certainly true within the Air Force to my personal knowledge.

IV. Military research and development officers are not scientists who command the respect of civilian scientists.

(*a*) This is not necessarily universally true; however, there is a strong tendency for the military to rule by command rather than by scientific fact. There is a great worship of the organization chart rather than of the capability of the individual worker.

V. The policy of rotating assignments for military officers militates against retention of officers who in some cases have the training, talents, and disposition to guide scientific research centers.

(*a*) This is certainly true to my personal knowledge.

VI. Research centers often are organized and administered as military organizations, with the attendant restrictive forms, procedures, regulations, and military discipline, which do not provide the optimum climate for research work by civilian scientists.

(*a*) This is certainly true to my personal knowledge.

VII. The lack of either a definite or consistent policy for organizing and administrating research and development centers leaves each center at the mercy of each change in commanding officer and executive. This creates an instability with no assurance that even the well-run research and developmet center will not become, with a change in officers, an unbearable situation.

(*a*) This is certainly true to my personal knowledge.

VIII. Several outstanding civilian scientists who have been associated with military research and development programs are reported to be in favor of changes in the governmental organization and administration of these programs.

(*a*) I believe this is true of every key scientist known to me.

IX. The funding of research and development is confused when handled with military budgets. Direct research and development costs are justified to and appropriated by the Congress as such. However, this does not give a true picture of the actual total cost of military research and development programs inasmuch as there are substantial indirect costs arising from military support functions in

the form of pay for uniformed officers, provision of capital facilities, and certain maintenance and operation expenditures.

(*a*) This is believed true.

In connection with the above it is reported that it is often felt necessary to build up a research and development center with such support functions in order to make it respectable in terms of size and complexity as a command for a colonel or a general.

(*a*) Not to my personal knowledge, but this could be possible in our present system.

LIST OF QUESTIONS TYPICAL OF BUT NOT NECESSARILY EXHAUSTING THE ISSUES OF PARTICULAR INTEREST TO THE SUBCOMMITTEE

1. Characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development:

(*a*) Policy of changing executives every 3 years or so does not provide proper continuity of policies.

(*b*) Generally speaking the military organization superimposes military rules to requirements on top of those needed to operate a civilian organization. Much of the purely military procedures with reference to such matters as the handling of supplies is totally unnecessary and undesirable.

(*c*) Promotion policies for officers serving on research and development assignments are generally not geared to proficiency in a scientific administration sense but rather as to performance as an officer complying with all military regulations.

(*d*) Scientific research and development is oftimes conducted on the sites of military installations and the rules that are applicable to the troops should not apply to the civilian engineer.

2. Military organization of research and development programs tend to create conditions which retard the work of scientists, or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel for the following reasons:

(*a*) There is a tendency to adopt, within military organizations accomplishing research and development, the principle of a civilian line of control as well as an overlay of the military. Thus a dual chain of command results, and, since the military officer is usually placed in overall charge, the civilian is limited in growth.

(*b*) The military judge the problem of replacement of civilians much like they do troops, that is to say, each man can be replaced by another. This makes no attempt to evaluate environment and places the esprit de corps above the mere filling of slots.

(*c*) The top civilian in each branch of an organization is usually rated and judged by his military superior. Often the qualities that are valued by one officer is heavily discounted by another and hence the top civilian engineers are at the mercy of the key military personnel regardless of capability of judgment.

3. It would be desirable to establish a civilian organization to administer military research and development programs. Military participation could be on the following basis:

(*a*) Liaison officers could be assigned to the staff of each civilian organization empowered to speak for their services and report back progress being made. They would not be in the administrative channel of control. Furthermore the officers so attached should wear civilian clothes rather than a uniform.

(*b*) The military responsibility for carrying out research and development could be treated much like that of any contractor wherein the requirements of the job to be done are set forth and the industrial company takes full and complete responsibility in performing. In this case the contractor would happen to be a Government civilian facility.

4. It would be possible to organize military research and development programs in such a way that the technical activities capable of being performed by civilian organizations are separated from those which are purely military. Where military support activities are necessary in connection with a research and development project, such activities could be under a military commander, but the technical research and development functions should be under civilian control using the liaison officer concept elsewhere discussed herein.

5. To what extent should the Department of Defense contract with non-Government institutions to carry on military research and development programs?

(*a*) Outside contractual assistance should be looked upon as an augmentation of available forces which can be quickly and efficiently focused upon a problem.

Contrarywise the alternative to outside assistance is recruitment of a competent staff and providing for funding usually on a permanent basis rather than a definite prescribed period of time by contract.

(*b*) The amount of outside contractual assistance should never exceed that which can be satisfactorily coordinated by the contracting agency. To do otherwise is to invite waste and duplication and the loss of reputation of the Government laboratory and its personnel. Just awarding contracts for the sake of spending the most money, does not promote either competence on the Government's part or efficiency on the agency doing the actual work.

(*c*) The added flexibility of being able to obtain help when it is needed can only be achieved by having, in reserve, a staff of engineer-scientists who can be brought into aspects of the problem on short order. This is wasteful if the Government institutions were to have extra personnel available, hence the efficient manner of proceeding is to award sufficient outside work to keep alive a cadre of scientific skills.

BACKGROUND OF RAPLH I. COLE (BORN AUGUST 17, 1905), ELECTRONIC ENGINEER

EMPLOYMENT RECORD

February 1951 to July 1952

In the present position, exercises technical direction of approximately 600 engineers, scientists, and direct administrative support, primarily engaged in the research and development of ground electronics for the United States Air Force. Specifically, the technical director is responsible for the following functions:

(*a*) Insure directorate cognizance of results of basic research, national and international, in those areas of the physical sciences which might have application to requirements of the research and development program of the directorate; guides applied research and development within the directorate to determine the soundness of new and/or theoretical engineering principles and their application to electronic equipment or systems for which the directorate is responsible; assigns specific applied research problems to be solved; and insures the timely incorporation into development of successful results of research effort.

(*b*) Insure the establishment within the technical staff and laboratories of procedures essential to effective planning, executing, and supervising the research and development program.

(*c*) Insure that all elements of the technical staff and laboratories which may be concerned are coordinated in the actions required by directive technical correspondence and that each can and does fulfill its share of the committment made.

(*d*) Review, correlate, and sign outgoing correspondence on technical matters prepared for the directorate to insure that it reflects coordinate directorate opinion, requirements, or recommendations in accordance with the policies of the director and the approved research and development program.

(*e*) Insure liaison and competent representation by engineering and technical personnel of the directorate with outside organizations and agencies as required to keep such organizations abreast of technical progress and developments which are within the directorate, and to assure integrated and coordinated planning and programing by keeping informed of trends and developments in the art within such organizations and agencies.

(*f*) Insure that directorate responsibilities in relation to production engineering and in-service engineering of electronic equipment developed by the directorate are fulfilled.

(*g*) Recommend, coordinate, and direct the implementation of basic policies regarding assignment of engineering responsibilities within the electronic development division.

(*h*) Review the directorate contractual program and assure that engineering responsibilities and actions with respect thereto are effected to provide timely completion of the program, consistent with legal and policy limitations.

(*i*) Insure long-range planning with respect to the research and development program, so that the directorate is enabled to accomplish its assigned mission.

(*j*) Represent the director on technical committees and interservice boards and panels as directed.

(*k*) Prepare and present agenda at the Development Advisory Council meetings.

(*l*) Coordinate with and through the Chief, Administrative and Technical Services, in all matters relating to administration of the technical staff and laboratories regarding decisions, supporting actions by the staff activities, and organizations of the Rome Air Development Center, the base, and with the directorate.

July 1942 to April 1947

This period covers military service, as follows:

Directly commissioned as a major in the Signal Corps, Army of the United States, on June 26, 1942, and entered active duty on July 6, 1942.

Initial assignment was as Chief, Radio Direction Finding Branch, Eatontown Signal Laboratory, Signal Corps General Development Laboratories. In this capacity, had direct charge of the research and development program of radio-direction finding, VHF fighter direction systems, meteorological position finding equipment, as well as radio intercept devices for the Signal Corps. Civilian staff was a maximum of 560; supervisor, Col. O. C. Maier. In addition, during intervals up to and including 4 months, held position of Acting Director, Eatontown Signal Laboratory, up to the time of reassignment as staff officer on the staff of the commanding officer, Signal Corps Ground Signal Agency in July 1944. During the interval while serving on this staff, applicant was promoted to lieutenant colonel, Signal Corps, on July 22, 1944, and held that position until being reassigned to the Air Force on February 1, 1945.

In the capacity of staff officer, was responsible for program planning, budget, etc., of all Eatontown Signal Laboratory projects; and served as staff officer to the commanding officer on all projects assigned to the Eatontown Signal Laboratories, including wire, telephone, RDF, and net activities. Supervisor, Brig. Gen. Victor S. Conrad.

From the period February 1945 until April 23, 1947, applicant was Chief of the Engineering Division of Watson Laboratories. At this time, applicant was charged with research and development of ground electronic devices used by the Air Force. He directed the efforts of a maximum of 800 engineers and technicians. Supervisors, Col. O. C. Maier and Col. Don Graul. Applicant was promoted to colonel, United States Air Force Reserve, on April 24, 1947, at which time he was discharged from active service. Adjusted officer efficiency rating for a period of service, July 6, 1942, to April 23, 1947, 47.70.

1935 to 1940

Title: Chief, Radio Communication Branch. Grade: P–4 to P–5. Salary: $3,200–$4,600.

Place of employment: Fort Monmouth, N. J.

Name and address of employer: United States Army Signal Corps Laboratories, Radio Communication Branch, Squier Laboratories.

Name and title of immediate supervisor: Paul E. Watson, Col. R. V. D. Corput, Major General Colton.

Immediate supervisor—present address: Maj. Gen. R. V. D. Corput (last), Office of Chief Signal Officer, Washington, D. C.

Nature of business: Engineering.

Number of employees supervised: 25 engineers.

Reason for leaving: Promotion.

Number of months extended leave without pay: None.

Part-time work: None.

Description of work: As Chief of the Radio Communication Branch, was responsible for engineering direction of research and development concerned with all radio communication problems of the Signal Corps, including RDF vehicular radio, meteorological radio, and field radio.

1929 to 1935

Title: Assistant Chief, Radio Section. Grade P–1 to P–4. Salary: $2,000 to $3,000.

Place of employment: Fort Monmouth, N. J.

Name and address of employer: United States Army Signal Corps Laboratories.

Immediate supervisors: Capt. W. H. Murphy and P. E. Watson.

Present address: Deceased.

Nature of business: Electronic research and development.

Number of employees supervised: 10 engineers.

Reason for leaving: Promotion.

Part-time work: None.

Extended leave without pay: None.

Description of work (under name "Ralph I. Cohn"): As Assistant Chief, Radio Section, and engineer in charge, "receiver design," Signal Corps Laboratories, was assistant in charge of engineering direction of all radio research and development conducted by the Signal Corps, and personally directed "receiver" effort designing such receivers as the BC–312.

December 1928 to February 1929

Title: Illustrator of radio text. Grade: N/A. Salary: $150 per month.
Place of employment: Radio Design Publishing Co.
Name and address of employer: Radio Design Publishing Co., Brooklyn, N. Y.
Immediate supervisor: Cannot recall.
Nature of business: Publishing.
Number of employees supervised: None.
Reason for leaving: To accept civil-service position.
Part-time work: None.
Extended leave without pay: None.
Description of work (under name Ralph I. Cohn): Prepared illustrations for a book entitled "Principles of Communications," by John T. Filgate.

July 1928 to December 1928

Title: Junior electrical engineer. Grade: P–1. Salary: $2,000 per annum.
Place of employment: New York City.
Name and address of employer: United States Navy, Bureau of Engineering (now Bureau of Ships).
Immediate supervisor: P. K. Thurston.
Present address: Unknown.
Nature of business: Engineering.
Number of employees supervised: None.
Reason for leaving: To accept employment in industry.
Part-time work: None.
Extended leave without pay: None.
Description of work (under name Ralph I. Cohn): Design and layout work on electrical apparatus for naval vessels.

ADDITIONAL INFORMATION

Other study courses

Industrial College of the Armed Forces, extension course, Emergency Management of the National Economy, September 1, 1950, to September 1, 1951. (1-year course.)

Your more important publications

Management of Research and Development, published in IRE Proceedings, July 1950.
Management's Role in Research and Development of Electronic Systems, published in IRE Proceedings, November 1950.
Management Aspects of Electronic Systems Engineering, published in IRE Proceedings, December 1951.
The Electronic Systems Engineer, published in IRE Proceedings, March 1952.
Peculiarities of Facilities for Research and Development, presented at IRE national convention, March 3, 1952.

Your patents and inventions

Patent No. 2427657, radio direction finding apparatus, September 23, 1947.
Invention, multicrystal controlled oscillator, February 16, 1935.
Invention, a maximum system of direction finding, February 1, 1934.
Patent No. 2004101, vacuum tube oscillator.
Patent No. 2176064, sealed high frequency transformers (with Paul E. Watson).

Public speaking and public relations experience

Organizer and present chairman of IRE, professional group on engineering management (organized 1951).
As colonel in the Air Force Reserve, organized in 1949 a management training program for some 65 Air Force research and development Reserve officers at the then Watson Laboratories, AMC, Red Bank, N. J.
Deliver periodic lectures to students at USAF Air Command and Staff School, Electronics Division, Maxwell Field, Ala., re research and development.

Membership in professional or scientific societies, etc.

Senior member, Institute of Radio Engineers.
Member, advisory council, sixth annual conference, administration of research, Georgia Institute of Technology, September 1952.
Chairman, Rome subsection, Institute of Radio Engineers.
Chairman, IRE, professional group on engineering management.

Honors and fellowships received

Awarded Legion of Merit, February 5, 1947.
Awarded Army Commendation Ribbon, November 1946.

Mr. RIEHLMAN. If there are no other questions, the committee will will recess until 2 o'clock this afternoon in this room.

(Whereupon, at 12:12 p. m., the hearing was recessed, to reconvene at 2 p. m. of the same day.)

AFTERNOON SESSION

Mr. RIEHLMAN. The subcommittee will come to order.

First of all, we want to thank you for your patience, General, in waiting for our subcommittee to assemble to give you an opportunity to testify before our committee in respect to the problem that we are very much interested in, and that is in research and development in the Defense Department.

General, I think for the benefit of the record, we generally know of your background and experience, but I think it would be well for us to have from you, first in your own words, what your background is and the experience which you have had in this field, and also following that, if you might give us your philosophy of this whole program of research and development in the Defense Department. That is a pretty big order, but I think you understand about what I have in mind.

STATEMENT OF MAJ. GEN. JAMES F. PHILLIPS (RETIRED)

General PHILLIPS. Well, sir, I joined the military service in 1923, and after a little over 30 years, retired a year ago in March.

About, roughly, 18 of those years were spent in various phases of research and development, some 8 years at Wright Field, roughly a year at Edgewood Arsenal, what is now known as the Chemical Center. During the war years, unfortunately I was stuck in Headquarters, Air Corps, from June 1940 until August 1945 on staff work in research and development, production and procurement of aircraft, and related work.

Then, from 1947 until 1951 I was with the Research and Development Board staff as the Air Force secretary, and from late August 1951 until March 1953 I was with the Cambridge Research Center at Cambridge, Mass.

Mr. BALWAN. Are you a West Point graduate?

General PHILLIPS. No. I graduated from the University of Iowa, majoring in hydraulics and received a so-called honorary appointment in the Corps of Engineers in 1923.

During most of this time, from about 1928 until now, I think I have been exceedingly fortunate in being able to spend so much time on research and development work.

I was interested in the research type of work during school, and probably more by chance than by anything else I am one of the few officers whose assignments seemed to be pretty much in one specialty rather than spreading out across the board.

During the years I have been fortunate in having a widening and considerable acquaintance with scientists and technical people, both within the departments and outside the departments, out in civilian life.

Mr. BALWAN. By whom are you employed now?

General PHILLIPS. At the present time I am with the Aircraft Industries Association, Shoreham Building, Washington, D. C.

Mr. BALWAN. What is your job there?

General PHILLIPS. My job is secretary of the guided missile committee of the Aircraft Industries Association and additionally working on such reasearch and development problems as the aircraft industry has which may require attention.

Generally, I might say that most of the Aircraft Industries Association's work is in fields other than research and development, but there are a few things that Admiral Ramsey, who is the president, has asked me to cover for him on research and development at the present time.

Mr. RIEHLMAN. That more or less brings you up to date?

General PHILLIPS. Yes; I think that is the background.

Mr. RIEHLMAN. I think that is enough data, and the members might want to ask questions as we move into some phases of your experience, particularly while you have been charged with these different research and development centers.

In your 8 years at Wright Field you were in charge of that entire program?

General PHILLIPS. Oh, no, sir. I was in the Aerial Mapping and Photography Section of the equipment in that, actually doing laboratory work of my own. We were a small group of four people, and I was actually working as a technican in the laboratory.

Mr. RIEHLMAN. And that was at Wright Field?

General PHILLIPS. Yes, sir.

Mr. RIEHLMAN. And then you went from there to where?

General PHILLIPS. I went on foreign service to the Philippine Islands and came back to Edgewood Arsenal in Maryland, where I was with the Chemical Corps, research and development activity for about a year, a little over a year.

And then I had a short tour at Kelly Field on inspection and engineering work, and from there I went directly to Washington from June of 1940 through August of 1945.

Mr. BALWAN. In what year were you promoted to general?

General PHILLIPS. I believe it was 1945. Yes; it was in 1945. The date of rank is January 20, 1945.

Mr. BALWAN. The thing that would interest us at this time, and it is of immediate interest, is your association with the Cambridge Research Center. Could you tell us when you reported to the center, what you found at the center in its organization and mission, and how you organized it, and the people you used to put around to give you advice in running it?

General PHILLIPS. Yes, sir. In the spring of 1951, in connection with my leaving the Research and Development Board, there was some discussion as to whether or not I should go to Rome, N. Y., or Cambridge, Mass. Finally, General Partridge, who was my commanding general of the Air Research and Development Command, asked me to go to Cambridge, Mass., and it was the latter part of August when I reported up there.

It was the spring of that year when the Air Research and Development Command was formally established with some 7 centers, 1 of the centers being Cambridge Research Center. Previous to that time,

Cambridge Research Center had been set up not as a major center of the Air Force for research and development, but I believe it was July 1 when the order was published listing it as one of the major centers.

One of the reasons for that action was the fact that just shortly before the Air Force had this very large project for air defense, which was with the Massachusetts Institute of Technology and generally known as Project Lincoln. This was an extremely important—and still is a high priority—work of considerable magnitude.

So Cambridge Research Center began to grow by having the additional responsibility of administering Project Lincoln; then about the same time that the Air Force made up its mind that it would be a permanent center, they felt that in the Boston, Mass., area would be an exceedingly fine place to have an effort of the research and development going on in the general field of atomic warfare. So there was an atomic-warfare effort set up.

About the time I arrived up there, the flying for the electronics and the geophysics work that was being pursued up there, the flight testing was almost all of it done from Rome, N. Y., a matter of a couple of hundred miles away.

And in order for more efficient operation, the Air Force thought it would be smart to have the flying work of the geophysics and electronics and, of course, additionally a considerable amount of experimental flying for Project Lincoln support to be carried on from the Boston area.

So in addition to the increase in responsibility that I just mentioned, Cambridge Research Center was given the responsibility of the Air Force flying for the whole center out of Bedford Airport, Lawrence G. Hanscom Field. That eventually resulted in negotiations between the Air Force and the Commonwealth of Massachusetts, with the Commonwealth deeding most of the field to us. This is background.

When I arrived up there, there were 1,200 people all told—men, women, and children—mostly civilians, civil-service people. This increased the activities going on up there, and resulted in a buildup on the order of 3,000.

Mr. BALWAN. Three thousand more?

General PHILLIPS. I believe to about 3,000.

As I was going up, and I knew something about the organization up there, the fact that there had been a relatively small group of people who had sort of grown up with the organization up to that time, and with the increased work that was being put up there, I felt that it was vital that there be some mature, experienced, competent people to join the organization in order for us to carry on the work with which we were charged.

As of the time I reported in, the commanding officer was a lieutenant colonel.

Mr. BALWAN. What was his name?

General PHILLIPS. Lt. Col. Peter J. Schenk. Temporarily he became my vice commander until his replacement arrived, a mature, experienced officer, Col. Howard Serig, who became my vice commander.

In the buildup, I recruited a number of other key individuals and as a part of the training to get the center set to carry out its work, I had a number of conversations with people both before I went up

and as I was arriving there about a No. 1 civilian who could be considered for technical deputy. I talked to a number of people within and without the Air Force on the matter.

Some of them are Dr. Louis Ridenour, who at that time was special adviser or chief scientist of the Air Force; with Mr. Eugene Zuckert, who had been Under Secretary of the Air Force; with Dr. Julius Stratton of the Massachusetts Institute of Technology. I concluded from my conversations and discussions with them that the best man I could get for technical deputy to me and to Cambridge was Mr. John Marchetti, who had actually built up the Cambridge Field Station as it was originally called after the war, and who had remained on there all that time.

You see, having served in the research and development activities as I had said, I had been very fortunate in observing types of organizations where the research and development work seemed to be accomplished most efficiently, and conversely some organizations were, in my opinion, not being carried out very efficiently.

At Wright Field, for example, which was of course in the early 1930's, it wasn't a large organization, but the military and the civilian people were intermixed on the basis of competency. We had laboratory chiefs out there who were civilians. We had military people who were laboratory chiefs. It was a mixture. Generally the civilians and the military—there was little distinction, either during office hours or after hours, between the military and the civilians. Military people entertained the civilians in their homes and vice versa, attended social gatherings and that sort of thing. Military were working for civilians, and some civilians were working for the military.

Mr. McCormack. How would they get along?

General Phillips. It worked fine. Admittedly there were not very many funds in those days.

Mr. McCormack. They were working together as scientists or technical men and not as any group distinction.

General Phillips. That is right. The other extreme was the old Research and Development Board, where there were a number of military people in the staff as well as civilians, and none of the military people or naval people, had any position of responsibility whatsoever. They worked entirely for the civilians.

Edgewood Arsenal was a place similar to Wright Field, where the civilians and military were intermixed, depending on the competency of the individual without regard to whether he wore a uniform or civilian clothes.

Mr. Balwan. Where was this?

General Phillips. Edgewood Arsenal in Maryland. So when I went to Cambridge, I put into effect the policy that civilians or military people would be used in positions, in key spots on the basis of their competency, and without regard to whether they were military or civilians except in a few cases where laws or directives were such as to require a military person.

Mr. McCormack. Did you incur any hostility as a result of that? I mean, from higher up.

General Phillips. Not any hostility. I had to remove my chief of administration and get another one in. He was a military lad who would not go along with that philosophy.

Mr. BALWAN. Who was that?

General PHILLIPS. Major Chaffee.

Mr. BALWAN. There is a Mr. Chaffee there now.

General PHILLIPS. Yes, no relation whatsoever, so far as I know. There was no open hostility. There always has been somewhat of a fundamental clash, let us say, between the military type of person and the civilian type person. My experience has been that if you insist that the man who gets the most responsible job gets it on the basis of his competence, regardless of whether he is a military man or a civilian, generally people go along.

Mr. MCCORMACK. The military being in command, if there is any clash, whether or not the source of the conditions that brought about the irritations or clash or whatever you want to call it between the two groups, would be in the military, would it not?

General PHILLIPS. I do not believe I quite follow you.

Mr. MCCORMACK. If you had an understanding man as commanding officer of the two groups, one military and the other civilian, the working of the two groups in an understanding way and the partnership angle, a partnership for the overall good, the leadership would really come from you?

General PHILLIPS. Yes; I presume so.

Mr. MCCORMACK. And if your leadership from the commanding officer that brings about disturbing conditions between the two groups, the source would be in the military in the main.

General PHILLIPS. Yes; at that echelon. Of course, there is a Secretary of the Air Force who is a civilian.

Mr. MCCORMACK. I am using you as an illustration. I am trying to get the benefit of your knowledge and experience to enable the subcommittee to get a picture as to what we think we shall recommend for the best interest of our country and the national interest of our country, to have these two groups with different states of mind, different disciplines, different backgrounds, different worlds in a sense, working together with the greatest degree of harmony possible.

General PHILLIPS. Of course, I think it is essential that somewhere along the line there is a single responsibility and single authority, so if you have two different groups, somewhere along the line they have to be subject to a single authority.

Mr. MCCORMACK. I would not challenge that. I was just trying to explore to see where, when one of these irritations and conditions arise, as a general nature, as a general proposition, where the source might be.

In other words, the commander is a military man. That is true, is it not?

General PHILLIPS. Yes.

Mr. MCCORMACK. I am not disputing that. But the wise military man will do those things, or try to do those things, that will reduce to a minimum friction between the groups.

General PHILLIPS. Yes.

Mr. MCCORMACK. Go ahead, General. You were talking on the subject of competency, when you got to Cambridge Center.

General PHILLIPS. I think it was working quite all right when I left Cambridge. Of course, there were minor difficulties when I got there.

There always are. And I think it is the only way to run a military research and development organization or any other type of organization, to have people put in the key spots on the basis of their competency without regard to a man or woman's nationality or religion or what kind of clothes they wear. I think that, gentleman, is perhaps oversimplified.

Mr. RIEHLMAN. That is the policy you carried out at Cambridge?

General PHILLIPS. Yes, sir.

Mr. RIEHLMAN. And you had reasonably good results, you think?

General PHILLIPS. Yes, sir; I think so.

Mr. MCCORMACK. Did you issue an order that when the officers were working, they would not wear their uniform?

General PHILLIPS. I did not issue an order, no, sir. I think I have a copy of what I said. I said something to the effect that personnel will be governed by the following principle: During the working hours the military personnel may wear either the appropriate prescribed uniform or civilian dress. Exceptions are during a formal inspection conducted by our headquarters or during military ceremonies when the military uniform will be employed. Also, the military would wear their uniform unless they were attending a predominantly civilian gathering or meeting. Civilian dress would be considered more appropriate when conferring with or visiting civilian organizations. The uniform was considered appropriate when conferring with or visiting military organizations outside the center.

In accordance with these guiding principles, some military personnel, particularly those assigned to laboratories may habitually wear civilian dress.

Little things like that break down the standoffishness between military and civilian people working in the same group.

POLICY MEMORANDUM 30–1

AIR FORCE CAMBRIDGE RESEARCH CENTER,
Cambridge, Mass., October 10, 1951.

Subject: Utilization of military and civilian personnel in this center.

1. Subject to such laws, regulations, or specific directives from higher headquarters which may make it mandatory that certain positions in this center be filled only by military or only by civilian personnel, it is the policy of this center that positions be filled on the basis of competency of theindividual, regardless of whether he is a military or a civilian employee.

2. One effect of this policy will be that when an officer's immediate supervisor is a civilian, the officer's effectiveness report will be in the form of a letter prepared by his supervisor in accordance with Air Force Regulation 36–10.

3. The effects of this policy will probably be most apparent within the laboratories, technical divisions, and some base service organizations. It will probably be felt considerably less within the operational units of the proposed research and development wing where a purely military chain of command will normally prevail.

JAMES F. PHILLIPS,
Major General, United States Air Force, Commanding.

Distribution:
10–6520 AB Gr.
All branches and laboratories AFCRC.

POLICY MEMORANDUM 35-1

AIR FORCE CAMBRIDGE RESEARCH CENTER,
Cambridge, Mass., October 11, 1951.

To: Military personnel.
Subject: Wearing of the uniform.

1. Effective immediately the policy of this center on the wearing of the uniform by military personnel will be governed by the following principles:

(*a*) During normal working hours military personnel may wear either the appropriate prescribed uniform or civilian dress. Exceptions are that during formal inspections conducted by higher headquarters or during military ceremonies, the uniform will be worn. Also, military personnel on duty at Laurence G. Hanscom Field will normally wear the uniform unless they are attending a predominantly civilian gathering or are working in one of the laboratory groups physically at Hanscom Field.

(*b*) Civilian dress is considered more appropriate when conferring with or visiting civilian organizations; uniforms are considered appropriate when conferring with or visiting military organizations outside of this center.

2. In accordance with these guiding principles, some military personnel, particularly those assigned to the technical divisions and laboratories, may habitually wear civilian dress. Officers will not interpret this as meaning that they may relax their standards of appearance when wearing civilian dress, nor that it releases them from compliance with pertinent Air Force regulations designating uniform requirements for personnel on active duty.

JAMES F. PHILLIPS,
Major General, United States Air Force,
Commanding.

Distribution:
All offs asgd or atchd to AFCRC.
All orgn down to br and sq or lab level.

Mr. BALWAN. The general has given his philosophy in this matter in this address he gave in 1952. You might want to read some of this into the record as being a type of the philosophy recommended by the general.

Mr. RIEHLMAN. I would be glad to have him read any portion of his address he would care to for the benefit of the subcommittee at this time. However, because of the value, I believe, of the address to our subcommittee in its further considerations of the subject, I would like it inserted in the record just as it was given at his retirement. I think probably the members have read it. I have read it, and it is a very fine statement that the general made at that time, and it deals with this problem in a splendid manner.

(The speech referred to is as follows:)

TEXT OF ADDRESS BY MAJ. GEN. JAMES F. PHILLIPS TO THE SCIENTIFIC ADVISORY BOARD TO THE CHIEF OF STAFF, UNITED STATES AIR FORCE, SEPTEMBER 10 1952

Dr. Von Karman, gentlemen, my past year at the Air Force Cambridge Research Center has been one of the most interesting and rewarding of my military career—for a number of reasons. I would like to tell you about several of these, because I think they have an important bearing on the general problem of managing research and development in the Air Force.

First, let me review—for just a moment—the history of this center. As many of you know, the Cambridge Field Station was established at the close of World War II to carry on a few uncompleted OSRD projects. From a very modest beginning of about 75 people, recruited by the then Maj. John Marchetti, the station slowly grew to a strength of about 1,000 by June of last year. Then, within the last 14 months, and as a result of the decision that this would be one of the permanent research and development centers of the Air Force, quite a number of new responsibilities were added and the character of the center has materially changed. Real-estate holdings have increased five times; the budget has doubled; and the personnel figure is now approximately 3,000. In addition to basic and applied research in electronics and geophysics, our responsibilities now extend

through development and test; and we have branched into the fields of radiochemistry and radiobiology.

Coupled with this rapid growth, we have experienced an almost complete change in key civilian and military personnel during the last year and a half. A few oldtimers still with us have moved up to new and broader responsibilities, but many top-level scientists and administrators have joined us from outside the center.

Lastly, and perhaps most important of all, Project Lincoln was established last summer—under the management of Massachusetts Institute of Technology—and we were charged with providing the necessary administration and support.

You see, then, that the past year brought unique opportunities for striking out in new directions, applying new techniques and procedures in managing research and development, and in developing a pattern for future operations in a more effective manner than before.

Your Scientific Advisory Board report on the conduct of research and development in the Air Force, popularly known as the Ridenour report, laid down certain basic principles of sound research and development administration. At Cambridge we have been able to carry out some of these principles. One of the most important of these is adequate use of civilian technical personnel; providing them the opportunity of growing to positions of major responsibility and authority at the Cambridge Research Center. We have an effective policy of complete integration of military and civilian personnel at all organizational levels.

At every level, we have attempted to find one man, the best man, regardless of whether he be civilian or military, and to place him in complete charge. We have abolished the previous dual chain of authority where each unit had a military chief and a civilian chief. We have also abolished the unwritten law that all jobs of importance had to be filled by officers and that officers should not work for civilian supervisors.

I have exceedingly strong convictions on this point inasmuch as, during my some 18 years of research and development in the Air Force, I have personally worked in organizations where all the key positions were held by military personnel, also in one—the Research and Development Board—where all key positions were held by civilians, and during the war it was my opportunity to have experience with an organization where civilians and military both held key positions. Gentlemen, this last is the only sound and sensible method of using people in military research and development.

At Cambridge we have three major technical directorates: Electronics, geophysics, and atomic warfare. Two of our directors, Dr. Landsberg and Dr. Schneider, are civilians. The third director is Colonel Jack. Each of these men has military and civilian personnel working in his directorate, and, furthermore, the military personnel in the directorates headed by civilians are not segregated into a special group under the supervision of one senior officer who reports to the director. Officers are intermingled with their civilian colleagues all the way down the line, and their effectiveness reports are rendered by their immediate supervisor, be he military or civilian.

We have had great success with this policy. I can say with assurance that it has had a very favorable effect on the morale of our civilian workers and that it has not hurt the morale of our military people.

As an extension of this principle, we have tried another experiment. We have encouraged our military personnel at the center to wear civilian clothes on duty on an experimental basis. We have found that this simple stratagem has been most helpful in counteracting the rivalries, jealousies, and class consciousness that inevitably develop between two distinct groups. Officers out of uniform, in dealing with civilian scientists, are forced to establish their position on the basis of intellectual achievement and demonstrated competence rather than rely on their military rank as a badge of authority. Civilians, both employees of the center and contractor personnel in universities and research institutions, appreciate the willingness of our officers to stand on their own feet. The psychological effect of an officer shedding his uniform and insignia of rank to attack a technical problem side by side with his civilian colleagues has been pleasantly startling. This one action has done much to break down instinctive barriers and has facilitated the growth of a real partnership based on mutual respect.

The Ridenour report made a major point of the administrative redtape, prevalent at the time of that study, which stifled creative work and harassed scientific personnel. We have fought some of our hardest and seemingly never-ending battles on this subject during the past year. My people and I are continually engaged in endeavoring to eliminate cumbersome or needlessly restrictive admin-

istrative regulations. We have made considerable progress in establishing streamlined local purchase, petty cash, and supply procedures. We are attempting to provide better library, documentation, and publications services. But, despite numerous small gains, we still have a very long way to go against the vast accumulation of ponderous administrative machinery inherent in direct Government operation of the laboratories. We will probably never become reasonably free from Government property accounting regulations, from civil service, or from platoons of inspectors who prescribe that certain information appear on desk nameplates of our employees.

In this connection, the close proximity of Project Lincoln as a standard of comparison and source of inspiration has been of inestimable value to us. Few of the internal procedures that harass our own laboratories at AFCRC as yet apply to a contract operation. Therefore, Project Lincoln represents a mechanism for really using high-level personnel in an efficient manner. If this experiment of the Air Force in managing research and development succeeds, it will be an event of major importance to military research and development.

Before World War II, the military services in general were able to make only limited and rather ineffectual use of the Nation's scientific potential in developing new weapons. During the war, science was mobilized through the medium of NDRC and OSRD. However, these agencies did not have the built-in military connections necessary in many cases to focus their attention on the major problems that stem from direct military experience. Thus, while the military services generally learned to appreciate the abilities of the scientists, no really enlightened partnership between the two existed.

Project Lincoln is the largest single effort of the military to establish a mechanism whereby the best results can be obtained from both civilian scientists and professional military people jointly tackling an extremely tough problem—in this case—that of air defense. We of the Cambridge Research Center are wholeheartedly convinced that Project Lincoln can make major contributions to solving the air defense problem.

To me, however, whether or not the Lincoln type of operation can be successful within the military framework is of even greater importance, not only to the Air Force but to all military research and development agencies. I personally am sure it can be successful if the present Air Force interest, including that of the Scientific Advisory Board, continues. My only regret is that I shall only be able to watch this experiment from the sidelines after next March 31, since the Air Force has advised me that I am to be retired as of that date.

You will hear of the progress of the Lincoln project from its director, Dr. A. G. Hill, following Mr. J. W. Marchetti, the technical deputy of the Cambridge Research Center, whom I would like to introduce now, to tell you something of our own technical program.

Mr. IKARD. Do we have copies?

Mr. BALWAN. I think the general might read particular parts of it.

Mr. IKARD. Just so it gets in the record.

Mr. RIEHLMAN. I would like the whole text in the record. It is not voluminous at all. We would be delighted to have you read any portion, if you would care to at this time.

General PHILLIPS. To reiterate what I have said and add a little bit, I would like to read four paragraphs.

Mr. RIEHLMAN. All right, if you want to do that.

General PHILLIPS. This is speaking to the Scientific Advisory Board of the Chief of Staff of the Air Force:

Your Scientific Advisory Board report on the conduct of research and development in the Air Force, popularly known as the Ridenour report, laid down certain basic principles of sound research and development administration. At Cambridge we have been able to carry out some of these principles. One of the most important of these is adequate use of civilian technical personnel; providing them the opportunity of growing to positions of major responsibility and authority at the Cambridge Research Center. We have an effective policy of complete integration of military and civilian personnel at all organizational levels.

At every level, we have attempted to find one man, the best man, regardless of whether he be civilian or military, and to place him in complete charge. We have abolished the previous dual chain of authority where each unit had a military chief and a civilian chief. We have also abolished the unwritten law that all

jobs of importance had to be filled by officers and that officers should not work for civilian supervisors.

I have exceedingly strong convictions on this point inasmuch as, during my some 18 years of R. and D. in the Air Force, I have personally worked in organizations where all the key positions were held by military personnel, also in one—the Research and Development Board—where all key positions were held by civilians, and during the war it was my opportunity to have experience with an organization where civilians and military both held key positions. Gentlemen, this last is the only sound and sensible method of using people in military research and development.

At Cambridge we have three major technical directorates: electronics, geophysics, and atomic warfare. Two of our directors, Dr. Landsberg and Dr. Schneider, are civilians. The third director is Colonel Jack. Each of these men has military and civilian personnel working in his directorate, and, furthermore, the military personnel in the directorates headed by civilians are not segregated into a special group under the supervision of one senior officer who reports to the director. Officers are intermingled with their civilian colleagues all the way down the line, and their effectiveness reports are rendered by their immediate supervisor, be he military or civilian.

We have had great success with this policy. I can say with assurance that it has had a very favorable effect on the morale of our civilian workers and that it has not hurt the morale of our military people.

Mr. RIEHLMAN. That is a very good statement.

Mr. BALWAN. We have had one thing which perplexed us, and we wondered how you met the situation. When you were thinking of coming up to Cambridge, you knew you would have an atomic warfare and a geophysics and an electronics unit. Did it bother you when you could not find a man familiar with all three fields and that you had to take a man who was primarily a specialist in one field?

General PHILLIPS. I would have preferred to have had someone who had overall competence in all three fields. However, probably the only one I had in mind that I thought could have filled the bill I could not have obtained, and that was Dr. Larry Hafstad.

Mr. BALWAN. Of the Atomic Energy Commission?

General PHILLIPS. That is right. And it did not bother me too much because my experience has been that a sound scientist or a technical man, if he is objective and if he is enthusiastic, will grow as time goes, even if he has been a specialist, so that a few years later he can spread his wings out into other areas of technical work.

Mr. BALWAN. The subcommittee, I am sure, is not trying to promote Mr. Marchetti. We are concerned about the position of technical deputy or director to head up three directorates. They have now a steering committee. Would you have chosen a steering committee to do that?

General PHILLIPS. Definitely not. I think committees in general, as far as the military is concerned I think they work out fine in Great Britain—but as far as this country is concerned, no.

Mr. BALWAN. Is a technical director necessary there who has line responsibility, who has authority below him and answerable to the commanding officer?

General PHILLIPS. I felt so, and I still feel so, because while in some areas I feel that in my mind and in my case I had considerable technical competence, I felt that it was better, as I said, if we had more responsibility to get a few key, mature, experienced people to help out with the work. The only way you can do that is to sort of subdivide the work a little bit.

My vice commander doubled in brass as generally being in charge of administrative work as well as being vice commander to me.

Mr. Marchetti handled the technical work.

Mr. BALWAN. Did he have line responsibility through the laboratory?

General PHILLIPS. Yes, he did, with the full knowledge that important technical matters that may have been partly administrative and partly technical had to come to me, or that in some cases I might step in and take a different view, over-rule him on some of his decisions.

Mr. BALWAN. Couldn't you have done the same job through the Plans and Operations, the Deputy Chief of Staff?

General PHILLIPS. I had long arguments with my general and superior general, General Putt.

Mr. BALWAN. Where was General Putt?

General PHILLIPS. At ARDC.

Mr. BALWAN. That was in Baltimore.

General PHILLIPS. Yes, he was deputy commander. I felt, and I still feel, that in a research and development organization in the military that the top guy had better be sufficiently technical so that he is the operations man instead of having a staff officer off on the side. So I insisted somewhat over the protests of a number of my officers, I insisted that we not have an operations man. We had a plans man, but not operations. The technical operations man was Mr. Marchetti and/or General Phillips. Administrative operations with Serig and/or Phillips.

Mr. BALWAN. Were you concerned about the military versus civilian problem when you put Marchetti up there and wouldn't you have preferred a military man as technical director if you could have had one or found one, let me say?

General PHILLIPS. It could have been if I had found one, except for the one important point, and that is that a military man would not have the normal expectancy of as long tenure in the job.

Mr. BALWAN. Is that important?

General PHILLIPS. That is extremely important insofar as technical continuity is concerned. It is vital. It is an absolute must.

Mr. RIEHLMAN. Mr. Ikard, do you have any questions?

Mr. IKARD. General, what about this rotation problem? I know that is a tough one from a military standpoint, but just generally what is your idea? Do you feel that, as Mr. McCormack has asked of several witnesses, and I think you are a fine example of that, that there might be people in the service who devoted their lives principally to this program to where they are getting to these places and stay a while rather than being rotated out every 1 to 3 years. I would like to obtain your evaluation of it.

General PHILLIPS. It is an extremely tough one.

Mr. IKARD. I know it is.

General PHILLIPS. Theoretically, I feel that we are in an age of specialization in industry and every place else, and that the military should specialize a little bit more, perhaps our military people can specialize, say, in research and development and people in production and procurement work or specialize in operational types of work.

That has one disadvantage, and that is a tendency unless a person is awfully objective to lose sight of the ball which will really be to fight the next war successfully. But, despite that, I think that there should be specialization allowed, because I don't know any successful business company, industrial company, that doesn't pretty much

allow people to specialize. There are a few people in the military who have been fortunate in specialization, Admiral Bolster, who retired from the Navy, who was a specialist; Gen. Frank Carroll, in the Air Force, and in the Army, Col. Rene Studler, who specialized in small arms.

I would like to see the military policy and practices allow more than they do at the present time of that. It is just pretty much happenstance now that a person is able to specialize.

Mr. IKARD. You feel that, under the present rotation system with which we are all generally familiar, doesn't that system breed this continual upheaval within these scientific establishments when you get a new commander? Isn't the history pretty well that each time you do get a new one that you have a certain period of readjustment and uncertainty among the personnel.

General PHILLIPS. By the same token, of course, there is unrest and uneasiness when a civilian head of a laboratory leaves and a new one comes in.

Mr. IKARD. The point I was trying to make is that it happens so much more frequently when you rotate a commander of a project or a base every 1 or 3 years, whereas a civilian's life expectancy may be 10 or 20 years. I know in one instance in the military they had 12 commanders in 9 or 12 years, I don't recall which.

Mr. BALWAN. Yes, and we had 1 technical director only for 8 years there.

Mr. IKARD. Do you think that this continual rotation by the military has a tendency to keep the civilians more or less in a continual upheaval?

General PHILLIPS. Oh, yes, and the junior military people, also.

Mr. IKARD. But the junior military people are a little better equipped to meet it.

General PHILLIPS. Some of them are, and some of them are specialists in their own right and have the same feeling of unrest and disturbance.

Mr. MCCORMACK. What kind of a man is Marchetti, or was he, under you when you were commander there?

General PHILLIPS. Yes, sir, he was. I think if you will bear with me, the best way for me to describe him is the way I described him in the address.

Mr. RIEHLMAN. You did refer to him in your statement here.

General PHILLIPS. I have a little better description, if you will bear with me for 2 minutes.

Mr. RIEHLMAN. Yes, sir.

Mr. BALWAN. What is this document you are reading from, General?

General PHILLIPS. This is a letter of commendation which I wrote to Mr. Marchetti when I was retiring.

Mr. BALWAN. General, did you write letters like this for all your employees at Cambridge?

General PHILLIPS. No.

Mr. BALWAN. Upon your retiring?

General PHILLIPS. No. I wrote a letter to the driver of the official car, to Mr. Marchetti, to Mr. Harold Foley, to Colonel Ingelido, and to Captain Logan.

Mr. BALWAN. The only reason I mentioned this, if we may go off the record——

Mr. RIEHLMAN. Off the record.

(Discussion off the record.)

Mr. RIEHLMAN. I think, for the record, General, it would be well for the committee to know: Did you ever have any connection or association with any of these 3 or 4 gentlemen you have mentioned before you went to Cambridge?

General PHILLIPS. With Mr. Marchetti—I met him once or twice when, a year or so previously, I was visiting there in connection with my Research and Development Board work. With Colonel Ingelido—I met him the first time a week before I went up there.

Mr. RIEHLMAN. The only interest we have, I am sure, is that we want the record well established that there was no association or friendships or anything that had any bearing upon your writing these letters.

General PHILLIPS. No.

Mr. RIEHLMAN. They are purely on the accomplishments of these gentlemen?

General PHILLIPS. Absolutely.

Mr. RIEHLMAN. That is good. I want it for the record so we will have it.

General PHILLIPS. If you like, I can make a copy of this available.

Mr. RIEHLMAN. I think it would be well to read it right into the record, if you would.

General PHILLIPS. All right. I will read the entire thing:

MARCH 16, 1953.

Subject: Commendation
To: Mr. John W. Marchetti
Technical Deputy, Hq AF Cambridge Research Center, 230 Albany Street, Cambridge 39, Mass.

1. It is difficult for me to list all of the characteristics and accomplishments of yourself during the time I have served as Commanding General, Air Force Cambridge Research Center, and you have served as Technical Deputy, since they have been so many and so varied. Therefore, I will limit my recording to the following of your accomplishments and characteristics which, in my estimation, are pershaps the most important from an official standpoint.

2. You organized the forerunner of the Cambridge Research Center in late 1945 under most adverse conditions and with a small number of personnel. You had faith in the basic soundness of the Air Force doing research and development in this area and, therefore, you stayed with the center under most unfavorable conditions until it was finally recognized as a major research and development organization of the Air Force in mid-1951.

3. Only a person of your sticktoitiveness, aggressiveness, and scientific ideals could have properly used your experience from 1945 to 1951 as a springboard to successfully assume the responsibilities and authority of the Technical Deputy of this center on August 28, 1951, as you did. Since that time the personnel of the center has increased approximately twice, the technical program (including administration and support of Project Lincoln) has more than doubled, and yours has been the technical hand which has guided this center over these 2 years.

4. I personally know that you have unsparingly devoted much of your off-duty time in the interests of the Air Force research and development. You have also had many opportunities to accept offers of employment at greatly increased salaries. Instead you have chosen to remain with the Air Force in the field of research and development.

5. It is with sincere approbation of your scientific ideals and with some 19 years research and development in the Air Force that I wish to officially commend you

for the manner in which you have performed your duties as Technical Deputy at this center and to wish you continued success and growth.

6. A copy of this communication will be placed in your 201 file.

JAMES F. PHILLIPS,
Major General, USAF,
Commanding.

Now, Mr. Marchetti's characteristics of sticktoitiveness, scientific ideals, aggressiveness in pursuing his work are the key characteristics that I would like to emphasize.

Mr. RIEHLMAN. At that point, let me ask you this question, General: With your background and experience in this field through the years, is it easy to replace a gentleman of that caliber?

General PHILLIPS. No, sir.

Mr. RIEHLMAN. Are there many of them available at this time?

General PHILLIPS. I doubt there is a single one available at this time.

Mr. RIEHLMAN. Let me ask——

General PHILLIPS. Over a period of years, yes; but——

Mr. RIEHLMAN. Could you give us any idea of the effect of the removal of a man of his experience and the years of service in that field would have on a project such as being carried on at Cambridge? Would you like to comment on it?

General PHILLIPS. I hardly know what to say. Yes, sir, I would like to comment on it. Bearing in mind that it isn't only Mr. Marchetti who creates a problem, when a good person leaves, it is generally that other good people leave, and that, in my estimation, is what has happened up there. Not only Mr. Marchetti, but Dr. Landsberg and Dr. Schneider have both left.

Mr. MCCORMACK. What kind of men were they?

General PHILLIPS. Very superior men; highly respected as scientists, and extremely capable.

My belief is that unless a man of comparable technical soundness and personal ideals of Marchetti is found, they will have a tremendous time getting good scientific people to join the organization.

Mr. RIEHLMAN. You don't feel that this committee that has been set up to take over the responsibilities that Mr. Marchetti filled there, which, as I understood it, is the——

Mr. MCCORMACK. Steering committee.

Mr. RIEHLMAN. Steering committee, is it?

Mr. MCCORMACK. Yes.

Mr. RIEHLMAN. Steering committee would ever be able to fill that position and carry out the work that he had carried out?

General PHILLIPS. Not in my estimation, sir. The committee is only as good as the people on it, and, without Schneider, Marchetti, Landsberg, and ——

Mr. RIEHLMAN. You wouldn't be in favor of a committee if you had men like Marchetti and Schneider and Landsberg, would you?

General PHILLIPS. No, sir; I wouldn't.

Mr. RIEHLMAN. Normally would you have a director responsible to the commanding officer and not have any committee set off to the side to advise?

General PHILLIPS. That is right, sir.

Mr. RIEHLMAN. All right.

Mr. McCormack. Did Mr. Gardner ever speak to you and ask for your opinion about Mr. Marchetti and Dr. Schneider?

General Phillips. Mr. Gardner?

Mr. McCormack. Yes.

General Phillips. Trevor Gardner?

Mr. McCormack. Yes.

General Phillips. No. Gen. Orval Cook did.

Mr. McCormack. Who is that?

General Phillips. Gen. Orval Cook did. Gen. Orval Cook, before he went overseas as General Gruenther's deputy, was Deputy Chief of Staff, Air Force, for materiel.

Mr. McCormack. General, having in mind a technical deputy—it is immaterial who it is—you appointed and you have confidence in, whom you respect, and he not only advised you, but there were three divisions under you and under him, the geophysics, atomic warfare, and electronics——

General Phillips. Right.

Mr. McCormack. Would you, under your ordinary procedure, conduct of your office, command up there, consult with the director about a matter, bypassing your technical deputy?

General Phillips. Oh, normally not; no, sir, although, wandering around, making visits and seeing what was going on, and talking to people and so on and so forth, it might be possible you would take it up with someone.

Mr. McCormack. Would you take it up with the technical director?

General Phillips. Generally.

Mr. McCormack. You wouldn't talk with somebody down below your technical director?

General Phillips. Well——

Mr. McCormack. Some division chief or somebody in the division?

General Phillips. Certainly not, if——

Mr. McCormack. And issue orders to him without consulting with him?

General Phillips. Certainly not, if it was something the technical director should have known.

Mr. McCormack. That is right.

General Phillips. No, sir.

Mr. McCormack. And assuming that it happened, that would have a disorganizing effect, I would assume, wouldn't it?

General Phillips. Well, yes, sir; I think so. Just generally, in any organization, the folks feel a little bit confused, let us say, if the boss man wanders down and talks to Joe Simpson about something and decides on something without letting the people know what he is going to do.

Mr. McCormack. And to the man occupying the position that would be evidence of what you might term military domination?

General Phillips. Oh, it might be, sir. It might just be thoughtlessness, carelessness, lack of experience.

Mr. McCormack. Well, I am eliminating thoughtlessness and carelessness; assuming it is a deliberate act. Taking a hypothetical case, suppose the commanding officer there had people meet him in his home who worked in the division and, in Dr. Schneider's case, where he wasn't present——

General Phillips. Just supposing, sir, as a theoretical question, sir, it is hard to——

Mr. McCormack. That is something you wouldn't do, isn't it?

General Phillips. Well, not normally, no, sir.

Mr. Balwan. May I ask a question?

Mr. Riehlman. All right.

Mr. Balwan has a question.

Mr. Balwan. The question that was raised in the presentations by Secretary Quarles and by Mr. Gardner was that in a research and development situation, which is more on the development end of the spectrum, it is more possible to operate a center with military personnel, whereas in an operation which is more concerned with research, it lends itself more to having a civilian technical director. Would you care to comment on that, as to whether that is a logical way to operate?

General Phillips. Oh, I think, in general, although subject to an awful lot of if's, that is probably true, if we consider the whole spectrum of research and development, because in basic research, development, and so forth, true basic fundamental research, you generally are dealing with unclassified types of work, and the immediate use of the work cannot be foreseen; it is just searching for scientific and technical truth.

That, generally, is done over a long period of time, and generally the average military person is more interested in seeing something rolled out the doors of a factory to get out in the hands of fighting men. That is the development.

However, that is an awfully broad statement, both of those estimable gentlemen made, because such things as the evaluation—well, such as the Weapon System Evaluation Group has embarked on—that certainly or should be a scientific approach to evaluating weapons after they are out in the field or after they are going out, and that is toward the other end of the spectrum.

Mr. Balwan. Could an organization such as the Patrick Air Force Base, which appears to be from our view of it, a highly military organization, be run in the same way that you operated Cambridge?

General Phillips. Yes, sir.

Mr. Balwan. With a technical director?

General Phillips. Yes, sir.

Mr. Balwan. You think it could?

General Phillips. Sure.

Mr. Balwan. That is a good point because they were making the exception in this case of Cambridge, that it would be probably more susceptible toward operation with a technical deputy director, and since most of the centers operated by the Air Force were more in the test field that it didn't lend itself to that type of operation. We have no idea of——

General Phillips. I don't take that point of view, sir.

Let's go way back in history. A thousand years ago wars were fought generally on a hit-and-miss basis and there were no professional armies. Then during the medieval times and later it became very much the thing to have professional armies. Now, gentlemen, we are swinging back in the other direction, where in the last war there were an awful lot of civilians putting their shoulder behind winning the war, and the next one, from what I read in the papers—it will be probably all the women, children, and everybody fighting the war; and if that is so, then it would be better during peacetime to

have our military organizations, particularly our research and development organizations, set up so that you would have military and civilian and women and anybody that we can find who is competent for the job, regardless of whether they are military or civilian—and that includes Patrick and a number of other centers.

Mr. BALWAN. That is all.

Mr. MCCORMACK. Mr. Chairman.

Mr. RIEHLMAN. Mr. McCormack.

Mr. MCCORMACK. Would you care to express your opinion as to the importance of research and development, what you opinion is today and looking reasonably into the future success, and confining it to the military field, and having in mind the national interest of our country?

General PHILLIPS. I think I can best comment on that by stating in my estimation—not only in my estimation, but in the estimation of a great number of people—purely from a technical standpoint, the Germans have been for the last 50 years the outstanding country in the world to breed and raise and utilize real scientists, schooling them, and most of the best scientific work has come out of Germany, and Germany almost won the last 2 wars, and I think they almost won it on the basis they were research-and-development minded.

Mr. MCCORMACK. Is the heart of research and development your scientists in the basic field—and when I say the "heart," I mean it is from him the discoveries come, isn't it?

General PHILLIPS. Well, in general, he contributes more to the discoveries. He makes more of the discoveries.

Mr. MCCORMACK. I think that is a fair statement.

General PHILLIPS. Then the proper evaluation of discoveries, in deciding which is gold or which are the gold nuggets and which are not, is a little bit more toward the military technical people.

Mr. MCCORMACK. But you have got to have the basic, anyway?

General PHILLIPS. That is right.

Mr. MCCORMACK. I didn't mean to confine my question to the point that there was not originality or there wasn't contribution—there is certainly marked contributions—in perfection.

General PHILLIPS. That is right.

Mr. MCCORMACK. And in applied research, in the production and in the engineering.

General PHILLIPS. Yes.

Mr. MCCORMACK. There is generally——

General PHILLIPS. In general, the basic research is most productive in places like universities.

Mr. MCCORMACK. And there is going to be an awful lot of failures. In basic research there are failures as well as successes.

General PHILLIPS. Yes, indeed.

Mr. MCCORMACK. And what might be a failure in some particular project might be advisable in the elimination process?

General PHILLIPS. Yes, sir. Or——

Mr. MCCORMACK. Also, from out of that might come a thought that can be developed in some other direction?

General PHILLIPS. Yes, sir. There are a lot of failures, and it is easy to cover them up in basic research because the scientist doesn't publish them, that is, the results.

Mr. MCCORMACK. That is true. But, on the other hand, they are the exploratory mind.

General PHILLIPS. Right.

Mr. MCCORMACK. As a matter of fact, business, I understand, in its research is looking ahead 20 years, that is, some of these big corporations.

General PHILLIPS. That is right; yes, sir Generally, they are putting more and more money into basic research.

Mr MCCORMACK. And one particular development might—one successful discovery—might be of a revolutionary nature.

General PHILLIPS. Right.

Mr. MCCORMACK. Take Dr. Bush—he is a great scientist.

General PHILLIPS. Yes, sir.

Mr. MCCORMACK. And he is a man with profound knowledge of practical nature in the military field, an application of the scientific mind to the military. Wouldn't you say that is true?

General PHILLIPS. Yes, sir.

Mr. MCCORMACK. Dr. Killian is a man of profound knowledge and experience, is he not?

General PHILLIPS. Right.

Mr. MCCORMACK. As a matter of fact, of course, we know that the hydrogen bomb, the atomic bomb, whatever else they might develop in the future, have all come out of the field of research, starting with the basic science, isn't that correct, General?

General PHILLIPS. That is pretty general; yes, sir.

Mr. MCCORMACK. And, as a matter of fact, research is unlimited?

General PHILLIPS. Yes.

Mr. MCCORMACK. It might be the development of a uniform that can save lives through resisting bullets?

General PHILLIPS. Yes.

Mr. MCCORMACK. A shoe that will reduce trench feet; isn't that right?

General PHILLIPS. That's right.

Mr. MCCORMACK. A pill that might purify water that otherwise would bring about dysentery to a marked degree?

General PHILLIPS. Right.

Mr. MCCORMACK. And all of that is important. There are so many ways, thousands of ways, in which research operates. It isn't necessary to research in something that will revolutionize, but that is vitally important in other directions.

General PHILLIPS. Yes.

Mr. MCCORMACK. What I am trying to ask you is your opinion of the importance of research, confining it to the military field and in the military field in connection with the national interest of our country.

General PHILLIPS. Well, there is no doubt it is extremely important, sir; and, as I said, in my estimation, the country that has been most successful in almost winning a couple of major wars is the country that did most of the research work and, unfortunately, this country has never produced research results in the order or magnitude that some of the other countries have.

Mr. IKARD. We are not doing it now, either, are we, General?

General PHILLIPS. We are not doing it now. The First World War—the tank, the poison gas came out of Britain and Germany; later on radar—essentially a British discovery; jet engines—Britain or Germany, as you will; guided missiles, out of Germany.

Sound research and development, good research and development, is vital to our existence. We have been lucky in the past in that we have been invited into wars or gotten into wars after they had been well along. We may not be next time.

Mr. McCormack. Have you given any consideration in the field of research to the defenses of our cities and our people?

General Phillips. Well, yes, sir. Of course, that essentially is what the Air Force set up Project Lincoln for, in a large way, the continental defense.

Mr. McCormack. The continental defense; yes.

General Phillips. However, we at the research end of the spectrum, scientists generally are looking for new scientific truths, and so forth, without any particular thought as to their application. When you narrow it down to the defense of our cities and so forth, that is more or less toward applied research. Here are known scientific facts and so forth. Which of those can we use to apply to the problem of successful defense of our cities and populated areas?

Mr. McCormack. So that any efforts on the part of Members of Congress or anyone else to try and strengthen and improve our activities in the field of research and the human relations that exist in society is doing a duty that might be very fruitful to the best interests of our country?

General Phillips. I should say so; yes.

Mr. McCormack. If I were to draw inferences—and if I am incorrect, I wish you would correct me, General—as to your state of mind—you believe there has got to be leadership, whether in the civilian or military side?

General Phillips. I think there has to be single authority as well as responsibility.

Mr. McCormack. Exactly. And you feel the authority should be on the military side?

General Phillips. Not necessarily. I realize—well, not necessarily. Let me ask you a question: Within the Defense Department, single responsibility is vested in Mr. Wilson. He is a civilian.

Mr. McCormack. Take, for example, at Cambridge research; do you think the commanding officer or the head of it should necessarily be an officer?

General Phillips. He wouldn't have to be.

Mr. Ikard. If I may interrupt, Mr. McCormack——

Mr. McCormack. Yes.

Mr. Ikard. As I understand you, General, your idea is that the most capable person ought to be in charge, and that ought to be the determining factor, whether he be military or civilian?

General Phillips. Yes, sir.

Mr. Ikard. The person who can get the job done is the one who ought to be there?

General Phillips. Of course, there are some laws, and so forth, that you gentlemen, or your predecessors, have passed which, for example, wouldn't allow a civilian as head of an organization like that to exercise court-martial jurisdiction.

Mr. Ikard. Oh, yes.

General Phillips. There are a few things of that sort where there are practical disadvantages in having a civilian directly in charge, but——

Mr. McCormack. I know lots and lots of military people, officers, who would just as soon work for a civilian as they would for another military guy. I was just simply trying to ascertain your mind and get your opinion, because your opinion is based on your years of experience and your studies.

General Phillips. Yes.

Mr. McCormack. This Hanscom Field is an operations activity, isn't it?

General Phillips. Yes, sir.

Mr. McCormack. Well, a military man would be in command there, wouldn't he?

General Phillips. Oh, yes; normally he should be.

Mr. McCormack. Yes.

General Phillips. Because the group out there is normally military.

Mr. McCormack. But if the best man is a civilian for the laboratory, then they should select the best man to conduct the laboratory, whether he is civilian or an officer?

General Phillips. Right. I did. Two of them were civilians, and the other was a military officer, who happened to be a doctor, having two degrees, I believe.

Mr. McCormack. I have no further questions.

Mr. Riehlman. Mr. Lipscomb.

Mr. Lipscomb. I have no questions.

Mr. Riehlman. General, would you have been willing to stay down at Cambridge to continue your activities there? Was your resignation voluntary of involuntary?

General Phillips. The whole course of action was something like this: In August of 1953 I was informed that come the next March, having served 30 years and 5 years as permanent brigadier general, I would be retired. I had had some eye difficulties, one before in March and a subsequent one later on, which resulted in loss of sight of one eye. So, instead of retiring under that provision, I was retired on physical disability, sir.

Sure, I would have stayed on, but to be specific, when General Partridge asked me if I would retire one day and come back out of retirement the next day as a retired officer and stay on, I told him, "No," because I felt I could go outside and get something to do where I would be useful to the country, as well as up there, and I am happy to state, with my present worry about guided missiles for the industry of the country—I have perhaps not as many people working for me, but it is very interesting work.

Mr. McCormack. General, I told some of my colleagues on the subcommittee that my first impression on meeting you personally the other day was that I had met you before.

General Phillips. Yes, sir; I have——

Mr. McCormack. I am trying to recollect where.

General Phillips. In Boston at some function with Mr. Volpe, I believe.

Mr. McCormack. No, not that I can recall.

General Phillips. Wasn't that——

Mr. McCormack. Because Mr. Volpe is the commissioner of public works in Massachusetts.

General Phillips. No, sir.

Mr. McCormack. Probably Mr. Calahan, his predecessor.

General PHILLIPS. This was shortly after I got up there, sir, I believe, in the fall.

Mr. MCCORMACK. Probably.

General PHILLIPS. In the fall of 1951, or something like that.

Mr. MCCORMACK. I can't remember; but if it was anyone, it would be Mr. Calahan, who was his predecessor.

General PHILLIPS. Might have been.

Mr. MCCORMACK. Bill Calahan, who is now head of the Massachusetts Turnpike Commission.

General PHILLIPS. Yes, sir. That is right, because I remember I——

Mr. MCCORMACK. He had the operation in his throat.

General PHILLIPS. That is right.

Mr. MCCORMACK. Cancer.

General PHILLIPS. Yes, sir.

Mr. MCCORMACK. Does that refresh your memory on it?

General PHILLIPS. Yes, sir.

Mr. MCCORMACK. Then you have refreshed my memory, because I told some of my colleagues, at no request from you, but at my own initiative, I tried to have your time extended because of information I had about the fine leadership you had given there, and I thought deferring your retirement would be for the best interest of not only Cambridge Laboratory, the center, but also the best interest of our country.

Mr. IKARD. Mr. Chairman, may I ask one question?

Mr. RIEHLMAN. Yes, sir.

Mr. IKARD. General, this is probably a hard one. If you prefer not to answer, feel perfectly free to do so. I would like to know, just briefly, what your appraisal of this research and development program is. Are we getting that job done? Is it an effective program?

Mr. RIEHLMAN. What you want to know is whether we are getting the optimum?

Mr. IKARD. Pardon?

Mr. RIEHLMAN. Whether we are getting the optimum?

Mr. IKARD. Yes.

General PHILLIPS. Well, that——

Mr. IKARD. I know that is something you can't just answer yes or no to, and if you prefer not to answer it, that is all right.

General PHILLIPS. No; I will take a stab at it. It is exceedingly involved. I could talk for days on this subject.

In general, I think, in view of the uncertainty of the world conditions and our stake in what happens to us, together with the traditional American philosophy of letting the other guy strike first, and the corollary to that is we never know when that is going to happen, that we couldn't do anything else than essentially what we are doing now, which is spending a tremendous amount of the taxpayers' money for military research and development.

As far as getting the optimum out of it, I don't think so. I don't think we ever will; in the Air Force, as an example, before the war, in 1939 or thereabouts, the expenditure for research and development was in the order of 2 or 3 million dollars. Now it is probably—I don't mean what is budgeted for as research and development, but actual moneys spent for research and development—in the order, for the Air Force, of a billion and a half dollars. That is in the order of six or seven hundred times what it was 15 years ago.

I don't think it is safe to assume that anything can build up to that magnitude, to that degree, in that period of time and everything be done as efficiently as we would like to see it. I do feel, perhaps getting a little bit closer to the question, and I have felt all the time, that there could be, or it would be nice, if there was a little better definition of the roles and missions of the various elements of the Defense Department among the three departments, Army, Navy, and Air Force, which, to my way of thinking, would tend to eliminate some of the parallel developments or overlap, or whatever you want to call it.

Mr. IKARD. In other words, there again, do you think it would be well, somewhere along the line of command, within the Defense Department, that somebody has to make this appraisal you mentioned a while ago and say, "We are stopping here on our basic side, and we are going into development and eventually production on this model?"

General PHILLIPS. Oh, yes.

Mr. IKARD. Whatever it is?

General PHILLIPS. Yes, sir. Of course, the theory, the organization exists for that.

Mr. IKARD. Well, I know it does, but——

General PHILLIPS. Of course, that is a tough question.

Mr. IKARD. I know it is, but——

General PHILLIPS. When something is far enough along to yank it out and put it into production.

Mr. IKARD. But don't we waste considerable time and money?

You are no doubt familiar with the guided-missile program. We have all kinds of conflicts and competitions and different ideas within the different branches of the services about whether this missile is better than this one, or what's what on it; and, just as a layman, with no understanding at all, it is a little frustrating to me to think of the people who are so highly competitive that we are apt to end up without any missile at all, maybe, because——

General PHILLIPS. Well, if war doesn't come for 20 years, one thing is the answer; if war comes tomorrow, well——

Mr. IKARD. Well, I understand.

General PHILLIPS. It is entirely different.

Mr. IKARD. And it is no easy decision to make.

General PHILLIPS. Yes, sir.

Mr. IKARD. I realize that; but are we getting this attitude—and I agree wholeheartedly with what you said about the German people—are we making any strides toward getting a reasonable research-minded segment of our military forces to where they are approaching it from that angle? Are we making any progress in that respect?

General PHILLIPS. Oh, yes. I think it is better than it was before the war. Of course, it is quite disturbing to realize that not only in the military but in civilian pursuits as well we are in this age of mechanization and so forth, which really requires more and more trained specialists; and our schools, our universities are not turning them out in the quantity or in the quality that they should.

Mr. IKARD. Yes.

General PHILLIPS. And whether or not they are going to catch up so that we have sufficient quantities and sufficient people, and numbers of people with sufficient quality, as far as their scientific background is concerned, to help us greatly, is quite a problem.

Mr. McCormack. You said, in respect to Congressman Ikard's question, it is better than before the war; but that is very vague. Is it as good as you think it should be?

General Phillips. No, sir; never will be.

Mr. McCormack. I know that, but all we can do is approximate.

General Phillips. Well——

Mr. Ikard. Is it as good as it should be?

General Phillips. This is a terrific question.

Mr. McCormack. You said you were one of the few officers whose assignment seemed to be in one specialty.

General Phillips. Yes, sir.

Mr. McCormack. I made a note of that. Could it be improved by officers receiving assignments that would be in one specialty?

General Phillips. I think so.

Mr. McCormack. That would not prevent the rotation system, but keeping them rotated within a specialty.

General Phillips. Yes. It is actually just a further breakdown of what, say, as an example, the Army has, where it has the Corps of Engineers, who careerwise generally specialize in civil-engineering work, the Signal Corps in something else. Now, what we are talking about here——

Mr. McCormack. You have your Medical Corps.

General Phillips. Is breaking it down a little bit more to allow subspecialties of research and development, in those areas.

Mr. McCormack. Whether a man wears a uniform or not, he is a scientist; he is science-minded, isn't he?

General Phillips. Sir——

Mr. McCormack. Just like a doctor who is doctor-minded?

General Phillips. Well, there are some who would prefer to work on scientific fields than other fields; yes.

Mr. McCormack. Now, you are in retirement. Have you observed the policy in recent years to give assignments to officers who will serve in one specialty?

General Phillips. Well, as I recall, the Ridenour report from the Chief of Staff of the Air Force pointed this out and recommended it. Yes; there has been some tendency in that direction. When the Air Force separated research and development from the Air Materiel Command and set up ARDC, that was perhaps a short-term step in that direction.

Mr. McCormack. Has there been the emphasis upon it that you think there should be?

General Phillips. No, sir.

Mr. McCormack. Don't you feel the higher you can have civilians in responsible position, not necessarily in positions of command, but in the line of command, that that has a favorable effect?

General Phillips. If he is a good civilian, yes; if he is a mediocre one, no, sir.

Mr. McCormack. Naturally, I am talking about a qualified man.

General Phillips. Yes; because I think the problem is to fight the next war. I think that requires military as well as civilian.

Mr. McCormack. Yes.

General Phillips. And I think the team spirit should be ever present, and that means civilians, civil-service people, and the military

should be used in accordance with their competence, right on up to the top.

Mr. McCormack. In connection with that, I have a bill in for an Assistant Secretary of the Army and the Navy and the Air Force for Research and Development. As a matter of fact, my bill went in for the Assistant Secretary before the Assistant Secretary of Defense was established. So I don't know to what extent my bill and my agitations for the past 5 years might have had in relation to that. It might be presumptuous for me to think that out of it that did develop, but I have always felt it is not the answer; but it certainly would be a marked contribution toward the solution to the extent that we can humanly make it so, if they have that responsibility, and the fact that the scientists and the technical men would have the knowledge in the higher echelon, that there is in a sense one who knows their mind, has their mind, and can represent them in the presentation of problems and projects and other considerations on the highest level possible. Have you any views as to that, as a general proposition, without committing yourself to any particular position?

General Phillips. Well, I will be very frank, sir: That is, if the Assistant Secretary's term of office was long enough for him to get himself read into the picture, long enough to do something, and long enough to follow through on the results of what he started, that would be fine.

Mr. Riehlman. If he is going to be there on the basis of a rotating program like the military people are, he would just get started and have someone else come in and take over?

General Phillips. Yes, sir.

Mr. Riehlman. Is that what you are trying to say?

General Phillips. Yes.

Mr. McCormack. I am afraid that depends on other——

Mr. Riehlman. Other things the public has more jurisdiction over than we, Mr. McCormack.

Are there any other questions?

General, I think the committee would be anxious for a comment from you in respect to our own activities as a committee. Do you think that this type of an investigation, if we might call it that, or a source of gathering information about this research and development, is a good procedure to follow, or are we just marking time?

General Phillips. No, sir. I think it is exceedingly good. There are different practices in the different departments. Which are the best, I have no reason to comment on particularly. I think your committee can do a lot in taking a look at seeing how the different departments are operated, where some of the good spots are, where some of the poor spots are, and draw your own conclusions as to what type of operations seem to be the most productive, and hope that it will expand over all the departments.

Mr. Riehlman. Would you have any suggestions for the committee in any particular fields that we should take a look at?

General Phillips. No, sir; I think not.

Mr. Riehlman. Now, we have the general's letter and answers to questions that we sent to him before us here. I would like to insert that in the record at this point, with the permission of the committee.

(The letter referred to is as follows:)

AIRCRAFT INDUSTRIES ASSOCIATION OF AMERICA, INC.,
Washington, D. C., June 7, 1954.

HON. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee
of the Committee on Government Operations,
Congress of the United States,
Washington, D. C.

DEAR MR. RIEHLMAN: I appreciate the opportunity of appearing before your subcommittee in connection with the inquiry into the military research and development program. Having served in the military for over 30 years, including some 18 in various research and development assignments, together with having rather extensive working and social relationships with scientists of all degrees since my schooldays, I sincerely feel competent—as a military man—to be entirely objective concerning the pros and cons of both "military" and "civilian" traits, characteristics, and capabilities in the overall problem of conducting research and development for the military establishments.

The following comments are submitted re the questions and reported problems listed in the attachments to your communication of June 2. Some of the questions are rather involved and in the sake of brevity, my written comments can probably best be amplified in accordance with your wishes during the hearings. The below-listed paragraphs correspond to the numbering of the questions and problems which I received.

ANSWERS TO QUESTIONS

1. No characteristics are inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development (for military purposes). However, practices—which I differentiate from characteristics—have, since the last war, been indulged in which are inimical to sound administration. The principal demoralizing practice is the tendency for the "military" person to consider all "civilians" as working for the "military" man but not with him.

2. Yes. The trend in present organizations tends to compartmentalize civilians as one class and military people as another. This is particularly noticeable in such things as might be termed fringe benefits, such as equal participation in afterhours social activities, and in being treated as a full-fledged member of the team during working hours.

3. No. This would only foment the military-civilian problem and depreciate further the team spirit that is absolutely essential in any organization for carrying out its program either civilian or military—in this case, the military research and development program.

4. First question: No. In a military research and development program a few things of the support type might be construed as being primarily military and some things of a technical type are undoubtedly nonmilitary. However, there is a considerably "gray" area for problems that arise from time to time which cannot be classed as completely military or technical. An example is that of an expanding facility. Personnel, money for the program, and facilities are never in exact equilibrium so a typical problem in the "gray" area arises when a decision must be made as to which of several technical programs is most deserving of a new facility. The building itself comes in the support category; the programs, of course, in the technical. An objective decision must be made by a person who has competence to judge both technical and support implications.

Another example is the assessment, let us say, of adequacy of machine tools in a shop whose primary function is to fabricate specialized experimental items for a scientific project. Such equipment may be classified as support but the need therefor must be considered in the light of the scientist's project. Here again, any objective decision should be made by a person who has competence in both fields. Another example is that of a proper library, which must be assessed from the same point of view.

Second question: No. However, at some point up the line a single person must inevitably have single authority, together with single responsibility over both technical and support functions.

5. The first questions are closely interrelated and in discussion thereof, research should be separated from development. To illustrate, let us consider a research and development program of an end item of materiel—say a guided missile. Since we are considering an end item for operational use, the complete materiel spectrum range covers basic or fundamental research, applied research, development, testing, and quantity production. Department of Defense contracts with nongovernmental institutions or private nonprofit institutions should be limited

to the basic, and possibly, applied research and the proving thereof, but should not extend through the development of the end item, nor into the quantity production. Development of the end item—beyond the breadboard state necessary to prove the research, and production, should be accomplished by private industry. This proper division of effort between a research organization and industry is well set forth by the National Advisory Committee for Aeronautics and the military departments in the national aeronautical research policy approved March 21, 1946. It is also supported by the Steelman report of the President's Scientific Research Board in the fall of 1947 which concluded, among other things, that applied research and development work should be placed with industrial laboratories. It is strongly urged that this particular conclusion of the Steelman report be made a national policy.

Depending somewhat on the scientific field in which a particular research and development program is being pursued, I feel that the military laboratories should engage in "in house" research in the order of 10 or 30 per cent of the research and development funds they have available for the program in order to maintain sufficient competency for the direction and evaluation of research which they have under contract.

COMMENTS ON REPORTED PROBLEMS

I. Concur.

II. Concur to the extent that a number of scientists have left or are leaving.

III. Concur.

IV. Disagree with this general statement. There are a number of military research and development officers who are scientists (or technical men) and whose scientific and technical competence is respected by many civilian scientists and technicians.

V. Concur.

VI. Concur.

VIII. This is true not only of civilian scientists but of some military people as well, I am sure. Changes, of course, can be detrimental as well as beneficial.

IX. I cannot agree that the last paragraph reports anything but the unusual case. Personally I, and many other military research and development people to my personal knowledge, were happier when we were doing research and development work in lower echelons such as laboratories than when we headed up large organizations. Furthermore, the "scientific" type of person has little understanding or appreciation or interest in the "support" necessary to provide him with the means for pursuing his usually specialized scientific pursuits.

In closing, I would like to record my opinion that the key to improved organization and administration of military research and development programs is very simple to state but difficult to gain honest support for. It is to utilize civilian or military personnel within the Military Establishment solely on the basis of competence of the individual and without regard to whether he is a military man or a civilian and regardless of race, religion, or sex. Furthermore, fringe benefits, such as admittance to clubs, travel privileges, honors, etc., should be based on the measure of the man's competence—probably best measured by his pay. I have seen lipservice given to this philosophy over many years. I have seen it pretty well carried out at some military laboratories years ago, but today, forthright acceptance of this very simple and fundamental policy among Military Establishments, and acting in accordance with it, is noticeably lacking.

Very truly yours,

J. F. PHILLIPS,
Major General, USAF (retired).

Mr. RIEHLMAN. Do you have any of them that you would care to elaborate on any more than you have here, General?

General PHILLIPS. Not unless you would like to have me do so, sir.

Mr. RIEHLMAN. Well——

Mr. IKARD. Mr. Chairman, may I ask the general one more question?

Mr. RIEHLMAN. Yes, sir.

Mr. IKARD. And that is, General, do you have in mind any of our laws, our basic laws, or the statutes, that Congress could pass on that you feel, from your experience, might not be working well or might be detrimental or might have a tendency to retard this program?

General PHILLIPS. Generally, as I said previously——

Mr. IKARD. And I ask that question with the view in mind that we might possibly introduce legislation that would change it.

General PHILLIPS. As I said previously, I have been in a couple of organizations where I think the mixture of military and civilian has worked out well, and those have been generally subject to the same laws that are now in effect.

Mr. IKARD. Yes.

General PHILLIPS. It is really, in my estimation, within the departments.

Mr. IKARD. It is an administrative thing?

General PHILLIPS. It is within their sphere to push for this philosophy of using the military and civilian as a team, the best person in the best spot.

Mr. IKARD. I know in many situations there may be some law in effect that is detrimental that we don't know about. That is the reason I asked the question.

General PHILLIPS. I wasn't aware of any law that handicapped me up at Cambridge.

Mr. IKARD. I wasn't either. Thank you very much.

Mr. MCCORMACK. Those responsible for assignment of senior officers, like yourself, in fact, all officers, but particularly senior officers—should exercise extreme care in getting the right type, not only from the angle of experience and background, but who are capable of welding into as good a unit as possible the military and those in the field of science?

General PHILLIPS. Yes.

Mr. MCCORMACK. As a general proposition, it comes back to individuals, doesn't it?

General PHILLIPS. It comes back to individuals, yes, sir.

Mr. MCCORMACK. A good commander, a fellow using good commonsense, that the scientists and the technical people respect?

General PHILLIPS. Right.

Mr. MCCORMACK. To begin with, they have respect for him?

General PHILLIPS. Right.

Mr. MCCORMACK. So the assignment of a man with experience that commands the respect of the scientist and the technical person is an important element?

General PHILLIPS. Yes, sir.

Mr. MCCORMACK. Another important element is the commonsense that an individual exercises?

General PHILLIPS. Yes.

Mr. MCCORMACK. Those human factors that enter into the life of all of us?

General PHILLIPS. Yes.

Mr. MCCORMACK. Even in Congress, our associations with each other, we have to have, particularly in positions of leadership, that appreciation and understanding of minds, to the point even where you might think the other person is wrong, but to understand why and respect the reasons why, their reasons for their views.

General PHILLIPS. Right.

Mr. MCCORMACK. There are so many things, but the great value is the selection of the man, and it is important, as you said, that there

be developed officers in the field of research and development whose assignments serve to keep them in one specialty?

General PHILLIPS. I think that is certainly true, yes, sir, because there are a lot of exceedingly well-schooled military people, with Ph. D.'s and all sorts of degrees in scientific fields, but unless they are allowed to specialize, 10 years after they have left research or development, they are not much use any more.

Mr. RIEHLMAN. Are there any other questions?

If not, we will recess the hearings until tomorrow morning at 9:45 a. m. in this room.

(Whereupon, at 5:40 p. m., the hearing was recessed until 9:45 a. m. tomorrow, Tuesday, June 15, 1954.)

ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

TUESDAY, JUNE 15, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON MILITARY OPERATIONS OF THE
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met at 9:45 a. m., in room 1501, New House Office Building, Hon. R. Walter Riehlman (chairman of subcommittee) presiding.

Mr. RIEHLMAN. The subcommittee will come to order. I would like to have the record show the members who are present. Mr. Ikard is on his way, and I understand Mr. Lipscomb will be here very soon. Mr. McCormack and Mr. Riehlman are present at the moment, and I understand Mr. Lantaff is on his way over, too.

We are very fortunate to have Dr. John Von Neumann, professor of mathematics at the Institute for Advanced Study at Princeton, N. J.

Doctor, you have been informed, of course, by our staff of our interest in this research and development program. You know that we are trying to develop as many facts and as much information as we possibly can along the lines as to whether or not we are getting out of our research and development program all that we should; and we are anxious to find out from people of your background, and I know you have served on many important committees, any views and information that can help advance this program of research and development.

That is in general terms exactly what this committee is interested in, and I think that we have sent to you, and I think that you have studied, several questions. I would like to ask this question of you at the outset, Doctor, whether or not you feel that this type of a program instituted by this committee is a worthwhile type of program, and whether we are advancing along the proper lines, or whether we are just rehashing something where we will never discover or develop or help this program.

STATEMENT OF DR. JOHN VON NEUMANN, PROFESSOR OF MATHEMATICS, INSTITUTE FOR ADVANCED STUDY, PRINCETON, N. J.

Dr. VON NEUMANN. I feel that the questions you are asking are the decisive ones and of course are questions which have been asked before, and it is very necessary to ask them again and again, and I think the best way to handle these things has not been developed yet, and it will take a long time before it is developed. So I think these are very important questions that should be looked at now.

Mr. RIEHLMAN. I appreciate that, and we recognize that we must reevaluate consistently and constantly our programs to try to develop better ones and more advanced ones.

NOTE.—Asterisks denote classified material deleted.

The subcommittee is very happy to have your appraisal in this field. With that statement, would you like to make a statement to the subcommittee, and then we will ask you some questions?

Dr. VON NEUMANN. May I then say a few things which come to my mind?

Mr. RIEHLMAN. Yes, sir.

Dr. VON NEUMANN. You will see whether they are in the direction which you consider most relevant, and you will then probably direct the discussion in the direction in which you think it should be directed.

I understand that you are concerned with the management of research and development in the Government.

Mr. RIEHLMAN. That is one phase of it.

Dr. VON NEUMANN. With the methods of developing it.

Mr. RIEHLMAN. That is right.

Dr. VON NEUMANN. The immediate questions are whether it should be handled in military organizations the way it is now, whether it should be handled in more or less separate civilian organizations, whether there should conceivably be a complete civilian organization to handle all research and development for the military.

If not, how much should be handled in house, and how much should be handled by contract. To the extent to which it is handled in military organizations, is there anything in the military organization which is not well suited for this kind of thing, or are the necessary adjustments made or what adjustments should be made?

I assume these are roughly the things you would want comment on.

Mr. RIEHLMAN. Yes; we very much appreciate your comments on those issues.

Dr. VON NEUMANN. Speaking of these issues, I would like to say that during the war, of course, there was a separate civilian organization which handled research and development. It did not handle everything, because there were military laboratories at the same time which, by the way, to a large extent, were manned by civilians, but still a large part of the research and development during the war was handled by a separate civilian organizations, namely, the OSRD.

It is a question which, of course, everybody has been asking, whether there should be such an organization now, or whether it should be renewed when an emergency arises, or how one should proceed. I would think it would be quite difficult to return to the old method, because the need for a separate civilian organization existed then because the military research and development organization was quite small in 1941, and it had to be expanded very rapidly, and the quickest way to do it, with amateurs, with people from the outside, was in a separate organization.

Now research and development in the military has grown enormously. It has nearly the dimensions of the wartime OSRD. It would be very difficult to graft another civilian organization on top of this. It must be admitted, of course, that if, as, and when there is an emergency, this will create a problem.

In other words, during the emergency of 1941 the fact that the existing organization was small made it easier to improvise and made it easier to make fresh starts. If there is another emergency like this, it will be much more difficult, because there is a large organization already, there are already many people who, by their past background, must be tempted to think that they know all the answers, yet when

there is a real crisis, nobody can know all the answers. This will be a source of complications. In other words, a large establishment is useful and necessary, but it also produces some rigidity. This cannot be helped. To sum it up: It will be quite difficult to set up a separate civilian organization.

So I would go on the premise that there will not be a separate civilian organization, but that things will be handled in the Department of Defense.

I realize that this is not the only possible way. In Great Britain there is a separate organization, a Ministry of Supply, which does research and development for the services, but the whole institutional and organizational background is very different, and I think it would be very difficult to copy it here in America.

Mr. McCormack. Will you state briefly what you consider to be the difference between the British and what would be here in a civilian organization?

Dr. Von Neumann. I don't know the organization very well, so the statements I make are superficial, but I think that a merger of the civil service and the military has taken place to a larger extent there than here. In other words, the military and the civilian organizations are probably more separate in their backgrounds and in their setup here than they are in England.

This is second-hand information on my part, because I don't know the British organization very well, but I know plenty of people who have worked in it. They uniformly said that it would not be easy to transplant. However, as I said, this is not my personal experience.

The thing that I do know first hand, and which impresses me greatly, is that it was much easier to set up the civilian OSRD in 1941 than it would be in the future, as I have said above. It could probably only be done by taking the existing military laboratories away from the military and this would produce even worse problems.

These laboratories are now working with the military and have adjusted to each other and now know each other's problems, and if they were separated, one would have to go through another apprenticeship in that regard. I think it is a very difficult operation, and one should think very carefully on it before one embarks on it. It would be much more difficult than it was in 1941.

Mr. Balwan. There is another possibility here which might exist. I understand that you are speaking of a civilian organization outside of the military department, but you want it to be understood that there might be a research and development organization within the Department of Defense, but still on civilian lines, in which the military support functions are distinct and separate from the organization itself.

Dr. Von Neumann. Very much so, and I argued against a complete separation. That is, separation to the degree to which the OSRD was separate, or the degree to which the British Ministry of Supply is separate.

Mr. Balwan. And we understand that you will speak to the point of the desirability of separating it within the Department of Defense.

Dr. Von Neumann. Within the Department of Defense, I think there could be more separation than there is today.

Mr. McCormack. You mean more autonomy?

Dr. Von Neumann. Yes, more autonomy. There are all sorts of difficulties in marrying the civilian function of the research and

development with the military and those things deserve very careful study in each case.

One of the major aspects of the problem is in a military laboratory, whose personnel is primarily civilian, that in most cases the administrative head of the laboratory is military. This, in itself, need not be wrong. The military produce many good administrators. (In this connection there is another viewpoint which ought to be brought in about administration, to which I will come in a minute.) However, there is one thing in the normal military organization which fits in very badly, and regarding this something should be done. This is the military rotation system in such positions.

Normally, an officer rotates out of a laboratory in 4 years.

Mr. McCormack. How often?

Dr. Von Neumann. Four years.

Mr. McCormack. I thought it was much quicker than that.

Dr. Von Neumann. I think that is true.

Mr. Riehlman. It is 2 years, as a rule.

Mr. Balwan. And at Cambridge Research Center they had 12 different commanding officers in the past 6 or 8 years.

Dr. Von Neumann. The Army Ordnance averages 4 years.

Mr. McCormack. We are talking about the Air Force and the Navy.

Dr. Von Neumann. This is, of course, very bad. No industrial organization would leave an executive for only 2 years in such a job. The laboratory director, who has to live with his staff and know them very well, of course, develops his main usefulness only after several years. Two years is completely absurd, because anybody in a complicated job spends the first year in finding out what it is, and the last year in preparing to leave.

There are exceptions. I have known laboratories where the same officer remained in charge for a decade, and some of those laboratories were very good ones, and in each case one of the main reasons why it was so good was that the man did stay so long.

It is bad for the professional career of an officer to stay too long on one assignment, and particularly to stay too long in a technical assignment. If an officer stays for 10 years, that is proof that he is interested, and that creates a presumption that he is well suited for that job. Yet, this is definitely the exception. This rotation is bad administratively and it makes things unnecessarily difficult for the civilians who are the laboratory head's lieutenants, and who are running the place.

It is unreasonable to expect an executive to readjust himself every 2 or 3 years to a new boss. It should be changed.

Mr. McCormack. In my mind, the uppermost proposition is what policy would be consistent with the national interest of our country? That is paramount. Everyone has to make sacrifices at times in the national interest.

On the question of rotation, without regard to the past, but based on your experience with the past and present, we would like to get your views as to how you think there might be developed that relationship between the military and the scientist that will be conducive to the best interests of our country.

Dr. Von Neumann. I think it will be desirable to develop officers in charge of major installations who should have a long tour of duty there.

MR. LANTAFF. Is it not possible that promising officers in the military faced with a long tour and the problem of getting lost in the military promotion cycle might shy away from research and development if they were on long tours. You would have a considerable pressure on the part of your military brains to stay away from research and development so that they would not get lost, so they could keep up with the promotions of their fellow officers?

Dr. VON NEUMANN. This is undoubtedly true; but I think the amount of good that the ablest man can do is important, too. So it would be preferable to get those who are sufficiently attracted to that job.

Mr. LANTAFF. Even though that might be an inferior type of officer.

Dr. VON NEUMANN. They are not inferior. They are probably better suited for this type of administration. They might be less ambitious, but even this is not necessary. I think it ought to be possible to develop a system in the military, where there are promotion possibilities for those officers, too. After all, the research and development in the military is a pyramid like every other part of every other organization, including the military, and the possibilities of promotion could be considerable. The officer in charge of the entire research and development system is a very high officer. I think the highest officers in this class are lieutenant generals, so this is a perfectly good goal, even for a very ambitious officer.

Mr. MCCORMACK. You mean the avenue for a reasonable promotion in justifiable cases should be established and be open?

Dr. VON NEUMANN. Yes, sir; it should not be bad for the officer's career that he has been sitting in one laboratory for 10 years. It should be realized and it should be established that this is an important branch of the military. This is, of course, realized, but it should be realized that this branch of the military has its own modus operandi.

Mr. LANTAFF. I think that there are many adjuncts of that policy of extending it which has to be looked into.

Dr. VON NEUMANN. I think the area is important enough that it should have criteria of its own, that whether or not an officer has a good record and is fit for promotion should depend on how he performs on the job under the criteria of this area; it means that this is a type of specialization.

Mr. MCCORMACK. We had evidence from a professional career officer who retired recently that in his opinion in the field of research and development, the best man, the best person, should be recognized, whether they are in the uniform or out of uniform in the field of research and development. That is in the laboratory work and development. What is your view on that?

Dr. VON NEUMANN. I am all for it. But one has to look into this question, too: What are the difficulties of bringing people into that area? My first remark was based on granting that the head of a laboratory is military. In this situation I consider it a mistake that there is not a research and development administration career within the military, and that the officers who are doing this are not doing it for a longer period.

Mr. MCCORMACK. By a commander, the head of the military, you mean a qualified man.

Dr. VON NEUMANN. Yes.

Mr. MCCORMACK. You do not mean somebody with his rank?

Dr. VON NEUMANN. That is right. It is true in many types of organizations, in industrial organizations, and also in academic organizations, that it is by no means necessary that the head administrator should be the best technical specialist in the field. There are other human properties which are needed for administration. However, the head should be somebody who has an absolute grasp of the field, who understands that it is important, who understands that it has autonomous criteria, and who wants to make it his life work, and not a short tour of duty.

I think the military philosophy of the short tour of duty is that the field commanders should have an appreciation and understanding of the technical things that back them up, and the best way to acquire this is to put as many of them as possible into charge of various laboratories, since this will educate them to understand the technical things which they will need in the field.

This, in itself, is reasonable, but it is an awfully expensive way to achieve this idea by impairing the administration of large laboratories which employ thousands of men and represent tens of millions of dollars in investment. It is a very bad idea to make the administration of absolutely vital units an area for education.

Mr. BALWAN. Couldn't there be an understanding where an officer attached to a research and development center could be there for training purposes or for familiarity with that, rather than for command and line responsibility?

Dr. VON NEUMANN. Of course. The head of the laboratory, whether military or civilian, could have a large number of military officers who are moving through the organization. I know one civilian organization, which I think is not in your province, but which really has the same problems, and that is the Atomic Energy Commission. Take the Atomic Energy Commission laboratory in Los Alamos, it is under civilian direction. There are, of course, numbers of military officers there. Also at Sandia Laboratory next door to Los Alamos, which does another part of the job. Some of the officers are there for short tours of duty. They are not running the laboratory. They are there for a short tour of apprenticeship, and depending on their seniority they have more or less important jobs, but they are not policymaking if the laboratory is not their lifework.

Mr. BALWAN. I had another question related to this subject. Speaking of the prestige that can be attached to a research and development officer corps for career purposes, I wonder if you are familiar with the system that the German Army uses in providing research and development ideas for the general staff in Germany?

Dr. VON NEUMANN. I am not too familiar with it. It is my impression, however, that during the last war the Germans did not manage their research and development well. I don't know how fair an impression that is, but it is my impression that they did not do their work too well. They did some things brilliantly, but they handled many others poorly.

By and large, the British organization was better and kept house better with the available resources.

Mr. BALWAN. We heard remarks from our own military people which seemed to admire the German system and credit them with

several discoveries which were far ahead of ours in the field of guided missiles, for instance.

Dr. VON NEUMANN. They were very good in guided missiles.

Mr. IKARD. I had the impression that their appraisal was that the German people were research-minded, and that they had an atmosphere of research that was far above ours, rather than the military system being better.

Mr. MCCORMACK. That was my impression, too.

Mr. RIEHLMAN. I think that was about the statement given by General Phillips, who gave us that information, that the scientists were really farther advanced and were moving faster in those different fields than we were in this country in World War II. The specifically named the guided missile and some other projects that they had pretty well under way in World War II, and on which we had not gotten started.

Mr. BALWAN. Apparently they had a better climate in which these ideas and research and development grow.

Dr. VON NEUMANN. For one thing, I think they failed in one, and that was a large-scale organization. They had some excellent men and some excellent projects. For instance, they developed a long-range guided missile far ahead of everybody else, but managed to get it into action when it was too late.

Mr. BALWAN. That was their production lag.

Dr. VON NEUMANN. So the overall planning of the effort was not good.

Mr. RIEHLMAN. The planning and the production were not properly carried together, apparently.

Dr. VON NEUMANN. Yes, they were weak in what is usually called systems analysis. They had one part of the system, but not the other. It is claimed they spent 1 year in getting the V–1 guided missile out of the condition where it "hunted." "Hunting" means that it doesn't fly straight. Apparently they could have launched their V–1's if they had not insisted on making them fly straight. The fact of life is that it is easier to shoot it down if it does fly straight. It would have been a better weapon if it had "hunted." However, the people who developed it were aeronautical engineers and they just would not produce an object which would not fly straight. So there was a lack in having no one to step in and tell that this "improvement" was harmful, and that they could have stopped the development sooner by 1 year and come out with a better weapon.

These higher level coordinations were not adequate. They were usually ahead of everybody else in guided missiles, but on the other hand, they completely mismanaged atomic energy, and they were slightly behind on rockets.

At one decisive point the Russians were ahead of them on rockets, and they probably lost the battle of Stalingrad because they did not realize the importance of rockets.

Mr. MCCORMACK. You were talking, before we started asking you questions. Will you come back to that, please?

Dr. VON NEUMANN. These were just remarks on one of the changes about the military management, in laboratories where there is military management.

There is the further question, whether there should be military management in these laboratories. One has to admit one thing in

favor of military management unquestionably, namely, that under the conditions under which the Government operates, it is very difficult to get good industrial executives. There is a very peculiar situation in these large research and development organizations, and quite particularly development plants that people whose job is in every respect the job of an industrial executive gets a salary that is 2 or 3 or 4 or 5 times less than what the men doing precisely the same thing would get in industry.

Thus there is a chronic shortage of executive talent in Government work.

However, there is one class of people who are trained to be administrators, and who are conditioned not to expect industrial salaries, and they are the military officers. Therefore, it is a fact of life that one of the important sources of managerial talent which is available to the Government is in the military, and if one wants to eliminate this, one has to do something about how to get industrial executives into the Government service, which is probably a very difficult thing to adjust to.

Mr. BALWAN. The OSRD, which was outside the military during the war, survived primarily because there was an emergency in which we could draw upon people.

Mr. VON NEUMANN. Yes; this was an absolute emergency. First of all, this was wartime, so everybody considered it completely reasonable that he did not necessarily receive the maximum pay for his particular talent, and furthermore everybody knew that it was for a relatively short time. This cannot be repeated in the long pull.

Mr. BALWAN. To some extent we have the parallel in the Atomic Energy Commission, where we have the Chairman and the general manager, who are military people, managers that we can probably keep in there, because they are the kind of people who are devoting a career to it. Would that be a correct observation?

Dr. VON NEUMANN. Yes. However, the Chairman has a high military rank, but by his background he is a civilian, and a man of independent means. The general manager, on the other hand, is a retired Army officer.

Mr. MCCORMACK. Does the man have to be a scientist in another field to occupy a managerial position?

Dr. VON NEUMANN. No, but he has to have a very good scientific education.

Mr. MCCORMACK. For instance, to what extent? A very good scientific education in what way? Would you sort of elaborate on that for the record?

Dr. VON NEUMANN. Well, he has to have a very good understanding and has to know the subject very well. It is not decisive that he should have made original contributions. It is more important that he should be able to understand human relations very well.

In science itself the criteria are, of course, different. There is a fundamental principle that the one thing that is absolutely important is originality, and it is not so important how good the man's human relations are. There it is a part of the code that you disregard how easy or hard a man is to get along with, and you ask primarily whether he can produce something new.

This is clearly not the primary criterion if you evaluate men from the point of view of their qualification for managing the affairs of

others. Yet, it is necessary there, too, that the man on top, although he will not understand everything in minute detail much better than everybody else under him, at least be not too far behind them.

Mr. McCormack. I think that is self-evident, but I simply wanted it for the record, the reasons for your opinion. Do you want to proceed now?

Dr. Von Neumann. Let me add another thing. All these things are important. In the long run they will be the ones that matter. However, one would be giving a completely distorted picture, from the immediate point of view, if one did not point out that right now there is another problem which is much more urgent. This is the problem of how we handle security. It is very serious and it is growing more and more serious as time goes on. At this moment this is our major problem and I think it would be very important that Congress, and this committee in particular, give it a great deal of attention.

The security problem in its present form is quite new. In less acute ways, of course, it always existed. However, the problem now is much more important than it was a few years ago, and we are now in a very peculiar situation, which always obtains when something becomes important which was not so important before. Then these ad hoc methods with which one could deal with the thing before it became important, prove to be inadequate and one sees all their inherent weaknesses.

We could afford to deal with security in an ad hoc manner as long as security problems and security cases were rare. But now security problems are gigantic, the attention of the public is concentrated on them, and therefore, we must develop a better and more systematic way to deal with them.

Right now we are with security in a legal no-man's-land.

On the one hand whether somebody is acceptable from the point of view of security is merely one of several qualifications for certain sensitive jobs. Now whether a man is qualified for a job is not a legal or judicial matter. It is merely a matter for the potential employer's subjective evaluation. It will therefore, be handled rather informally.

On the other hand, public attention is now focused on this problem, and the public frequently views security proceedings as minor trials for treason. Yet we are still living with a system where this is an administrative matter and handled administratively and not judicially. This is a very bad situation because by now the public puts a judicial interpretation on all the administrative measures that are taken, and the administrative measures, have to be taken by administrators and not by judges, and, therefore without most of the safeguards that would surround a judicial procedure.

We must either convince the public that it is not a matter involving a man's honor and good citizenship whether he is or is not a security risk, in which case one can continue to handle it informally and administratively, or else we have to admit that it is a capital matter in which case one has to develop judicial methods and deal with it.

Practically speaking, I think that it will be hard to convince the people at large that a security matter is not a capital matter. By now everybody believes that this is very important, that this has a lot to do, no matter what we say, with loyalty and good citizenship. Conse-

quently, I think you ought to consider very seriously how to get this from the administrative into the judicial area, presumably by legislation. Of course, this will not be easy.

The legislation will have to very very careful, and it would be rash and improper for me to make detailed suggestions, but I think we should realize that this by now is a responsibility of the legislature and ought to be recognized by it.

Mr. RIEHLMAN. Apparently you feel that this matter of security is having a tremendous effect on our scientists working in these different fields of research and development for the Government?

Dr. VON NEUMANN. Yes, it has a very considerable effect. I think that remarks like those that scientists will cease to work for the Government, and so on, are loose and I would not take them quite seriously, but that this disturbs people, that this is a very serious matter, is certainly true.

Mr. RIEHLMAN. In your experience, have you had many people call that to your attention and discuss it with you?

Dr. VON NEUMANN. As you surely know, in the circles in which I move it is very hard to keep away from this business. The problem is not how much you hear about this, but how many opportunities do you get to talk about something else, and I have just thwarted a very good occasion right now.

Mr. RIEHLMAN. I am sure there is plenty of talk about it. The thing that we are primarily interested in is just exactly how it is affecting the research and development program and the scientists participating in it.

Dr. VON NEUMANN. It is very disturbing, because very many people are worried about it. Very many people who have some trivial blot way back in their past do not know whether they can take a chance on getting into sensitive work, although the matter may be irrelevant, and they could do very good work in this area.

Mr. MCCORMACK. Outside of that on the question of security, suppose the policy of the military is massive retaliation, which means the offensive, and a scientists believes that in addition to a strong offense there should be strong defenses established for the protection of the people in our cities, some people might construe such a person as a security risk because he is a strong advocate of research for defensive purposes as well as offensive purposes.

That goes into thought control, doesn't it?

Dr. VON NEUMANN. It certainly could. There is a grave danger of confusing a technical opinion with a political intention.

Mr. MCCORMACK. How serious is that?

Dr. VON NEUMANN. However, much more trivial things than this are dangerous. I mean, it is very dangerous that large numbers of people live in constant fear because some associations they had in the past, some indiscretions they have committed in the past may come back and damage them and nobody who is not absolutely unblemished knows for sure where he stands. Nobody knows what the methods of rehabilitation are, or if they exist. Also, to have once been dropped for security reasons, is for the average person, and especially for small people, a professional catastrophe. It is perfectly true that this applies only for sensitive jobs, but more and more segments of the industries in which anybody is expected to be employed have sensitive jobs. Many large companies find it embarrassing not to be able to

move their people around freely, and so it is a very important professional qualification to be clearable, and to lose your clearance in some industries is about as pleasant as for a doctor to be expelled from the AMA.

It is a very serious thing which affects people's professional reputations and it is a fiction, which was true a long time ago, but it is not true now, that these are confidential matters that are handled in camera. To have these things regulated by law and judicial process is just as important as having a civil service. It ought to be carefully thought out how rigid the rules should be that will cover this area.

Mr. McCormack. I do not think that that last expression of yours will find anything but hearty approbation by anyone around this table. But we are here listening to you present your views for our benefit and to enable us to see what we can do to improve it.

Dr. Von Neumann. I think I have touched on the critical area.

Mr. Lantaff. In connection with the security-risk problem you have mentioned, that it is a legislative matter, what specific recommendations would you have in that field?

Dr. Von Neumann. I would certainly not undertake to suggest a legislative program. It is very difficult. But I think it ought to be possible to have legislation which defines quite rigidly in civil service and also in working on Government contracts what the criteria of security are, under what conditions past behavior before the enactment of these laws will be evaluated, which set the relationship to the principle of not passing ex post facto laws and of avoiding "double jeopardy." Some agencies make a real effort to make these administrative security boards operate almost like a court. Others do it much more informally. However, in fact, none of them operate entirely like a court.

Mr. Ikhard. In many instances it is not even handled by an administrative body.

Dr. Von Neumann. There are, of course, all kinds of pressures bearing on these people, and in cases where everybody would like to keep the matter confidential, it cannot be kept so, because everybody thinks that it will come out anyway and acts accordingly.

By now it is clear that these problems will be with us for a long time. Indeed, unless the Russians reform, or unless there is a war very quickly, these problems will be with us for decades.

Mr. Lantaff. I take it that you mean that the Executive order under which we now provide for clearances or the finding that somebody is a security risk is not a good Executive order in that connection?

Dr. Von Neumann. I think mainly, that it is by now the third Executive order in this area. In other words, the rules have been changed 3 times, which makes it possible to try people 3 times for the same offense. It is true that it is not an offense, and it is true that it is not a trial, but public opinion views it that way, and no matter what we tell each other, some of the odium of multiple trials for the same offense adheres to it.

Mr. Lantaff. You make the point that if I am a scientist and I got into the Government at a time when, let us say, Cuba is a part of the free world, and then later on Cuba becomes dominated by the Communists, and I have a large segment of my family in Cuba, that I might find out that under a change in world events I might become a security risk.

Dr. VON NEUMANN. This is not even what I mean. This is, of course, a hardship and something ought to be done about hardships of this type, but they are inherent in what goes on in the world that such hardships will arise. The thing that really worries me is this, that if somebody's name was considered under the second Executive order which dealt with these matters, and he was cleared, he has then a bona fide right to assume he is really cleared, yet there comes along a third Executive order which makes the criteria more rigid. Under those conditions it is not the individual's, but the Government's fault that the second Executive order was too lax. It is the Government's fault that it did not immediately come up with the proper law and not the individual's. What I say here are just normal principles in law.

If one day Congress decides that the laws of murder are too lax, then everybody who has been tried under previous laws will get the benefit of that. It is just a dangerous principle that the Government finds out in successive stages what the law should be, and the individual incurs multiple risks in the process.

I realize that what I say is legally sloppy, because these are not laws, but the merit of the case is still this.

Mr. IKARD. In other words, what you are saying is that if a person is cleared under existing regulations, and then at some subsequent date he should be criticized or in effect have an unfavorable ruling for having worked during the period that he was cleared under a bad order or a bad law?

Dr. VON NEUMANN. Yes; in this case I think it is only fair to say the Government is to be blamed. If the rigid criteria are the proper ones, it is the Government's fault that they were not applied immediately. It is no excuse that it was an earlier, and other, government.

Mr. IKARD. You are stating a very fundamental principle, that we adhere to, or supposedly has been one of our fundamental precepts of government.

Dr. VON NEUMANN. I think it is a fundamental principle and one observes it in every other area. Security offenses are not more dangerous than espionage, and not more reprehensible than murder. Hence, they need not be treated without the safeguards with which the latter are treated.

I do not say this in any contentious spirit. I merely say it is high time to go and do something, and that Congress should do something about this.

Mr. LANTAFF. How do you handle it when you have a change in world events which would change your concept of a security risk like the situation I mentioned in Cuba? Do you think that if a person is cleared this year, and 20 years from now that country is under foreign domination, that they should forever be cleared regardless of their sympathy?

Dr. VON NEUMANN. That, I would say, is an accident for which the individual is not responsible. The Government, of course, should protect its interest and in that case the Government should find a formula to move the man into an unsensitive position without suspending his clearance. Such things can happen in any organization, that a man, who through no fault of his own one day ceases to satisfy certain criteria, so that the organization cannot continue him in a job for which he is not suited. Then one has to find some tactful

form for reassigning him but without offense or damage to his reputation.

Mr. McCormack. Don't you think that as important as that is, that that is something that is bound to resolve itself in a satisfactory way? We are going through a sort of a wave, a burden, and everybody is under strain. There is a lot of fear around in the world, and don't you think that that is something which the logic is bound to satisfactorily solve?

Dr. Von Neumann. I think that the strain in the world may go on a good long time. The strain under which we live politically may easily continue for a generation.

Mr. McCormack. That is dependent on the other side, what their actions are.

Dr. Von Neumann. But it has been going on for 10 years, and 10 years is a long time; and if it has been going on for 10 years, it might easily go on another 10 years.

I have a lot of confidence that the problem will have to be solved, but I think it will have to be solved by legislation. I do not bank on the problem of security disappearing, because it is completely outside our control, it exists for reasons about which we can do absolutely nothing. It may not disappear.

Mr. McCormack. Legislating in a period of emotionalism is liable to bring about greater abuses than legislating under more normal conditions. I know that through experience.

The thought in my mind was along the lines that Mr. Lantaff indicated, that probably the immediate solution would be by Executive order. When you use the word "legislation," you are using it in terms of governmental action, are you not, in the broader sense?

Dr. Von Neumann. It could be any kind of governmental action, provided that it did establish the judicial character of these proceedings.

Mr. McCormack. During the war there existed a pretty effective working partnership between the military and the scientists. You have testified to that already.

Dr. Von Neumann. Yes.

Mr. McCormack. And there was between the professional men and the scientists, there was an effective working relationship, or we might term it partnership for descriptive purposes.

Dr. Von Neumann. Yes; I think it worked very well.

Mr. McCormack. Any kind of a relationship between human beings requires mutual respect and an understanding mind to get the maximum results. That is axiomatic, anyway, isn't it?

Dr. Von Neumann. Yes.

Mr. McCormack. Do you think the relationship between the military and science, and I will confine it to the scientist, is as good now as it was during the war?

Dr. Von Neumann. Yes; I think it is intrinsically as good.

Mr. McCormack. You say intrinsically. Is it as good?

Dr. Von Neumann. Oh, yes. If anything, it is better. In other words, the two groups are more used to each other. I would think that the things which mainly require looking at are organizational matters and not so much the attitudes of individuals.

Mr. McCormack. Will you elaborate on what would come under the purview of organizational matters as you just used that phrase?

Dr. VON NEUMANN. Well, for instance, the thing I mentioned earlier, that an officer in charge of a laboratory should not be rotated out of that job very soon. This is typically something which has nothing to do with the attitude of the individual. There is nothing wrong about the attitude of an officer who doesn't want to do something which harms him professionally, and right now staying on in one place harms him professionally.

There are a few other things, and there are laboratories which are on military posts where the social coexistence of the military and the civilians require some adjustment. I am sure you know about these matters.

Mr. MCCORMACK. Dr. Vannevar Bush is a pretty good authority; would you say?

Dr. VON NEUMANN. Yes.

Mr. MCCORMACK. Have you read his article in last Sunday's New York Times?

Dr. VON NEUMANN. Yes, I saw it.

Mr. MCCORMACK. Did you notice in there that he went to the extent of saying that the relationship has been gravely damaged and is in danger of being gradually destroyed? Did you see that?

Dr. VON NEUMANN. Yes, I saw that.

Mr. MCCORMACK. What are your views on that?

Dr. VON NEUMANN. I wouldn't say it is being destroyed. It is certainly being damaged. There is no doubt about it.

Mr. MCCORMACK. His language was that it is being gravely damaged.

Dr. VON NEUMANN. I wouldn't say its relationship to the military, but its relationship to the Government.

Mr. MCCORMACK. He went pretty thoroughly into it, and he covered respective views pretty thoroughly. He said:

> During the war there was produced an effective working partnership between scientists and military men, in fact, more broadly between professional men and officers of Government. It grew slowly, and it encountered many obstacles, but the time came when civilian scientists and engineers were working in harmony with military men under conditions of mutual respect, contributing their joint efforts effectively to a common cause. This was an exceedingly important and valuable partnership, for it is the nature of modern war that neither military men nor scientists alone can grasp the trends in the art and its probable evolution; it can be grasped in concert but only if there is an atmosphere of understanding and mutual regard.
>
> This partnership, so essential to our future safety, has been gravely damaged and is being gradually destroyed. This is indeed a matter which warrants the earnest thought of us all. In one way or another, the trend must be reversed, for we face an adroit and skillful enemy who has shown that he can apply science effectively to means of waging war.

Now, coming from Dr. Vannevar Bush, I consider that to be quite significant. Have you any views to express on that subject?

Dr. VON NEUMANN. I wouldn't be quite so pessimistic. In other words, I wouldn't use the words that it is being gradually destroyed. I would certainly say that it is now being damaged and endangered.

Mr. MCCORMACK. Yes; that is the point he stressed and the gradually destroyed was to emphasize the fact that it has been damaged to a grave extent.

Dr. VON NEUMANN. There was one more thing I wanted to mention, but I forgot to bring it up earlier. I think a modus operandi is set up for running laboratories by contract. This was done by the Govern-

ment and was very successful in several cases. It is, without explicity stating it, a principle that I think everybody believes in, that if anything exceptionally difficult has to be done, it is most frequently done by an ad hoc contract.

Consider what happened when the Korean war started and simultaneously with this, although it was not particularly related to it, the inadequancies of our air defense were realized. Immediately we set up a contract at the Massachusetts Institute of Technology. One of the very best laboratories of the Government, Los Alamos, is run by contract. Another good example is the Rand Corp.

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Mr. LANTAFF. Have you ever evaluated your thought there to determine whether or not there have been greater scientific achievements that have been made through letting a contractor or a private institution carry out the work rather than have it done by a Government-operated laboratory?

Dr. VON NEUMANN. You mean in research and development?

Mr. LANTAFF. Yes.

Dr. VON NEUMANN. I think by and large the contracts have been more successful.

Mr. LANTAFF. Is there any way that we could get a comparison of that?

Dr. VON NEUMANN. My impression, for instance, is that in the field of operations research where a number of directly owned Government operations have worked and where the Rand Corp. has worked also, that Rand has by and large been a stronger organization and has handled more difficult problems, and has done better than what the Air Force could have done directly in a laboratory of their own. It is a very successful operation.

I think that, as a technical Government laboratory goes, the Los Alamos Laboratory is something quite exceptional and outstanding. It is a contract.

I repeat: You will probably find that each time when something really difficult came up, the people in the Government who had to make the decisions instinctively started to look for a contractor. * * *.

Mr. RIEHLMAN. I know the doctor has to be out of here by 11 o'clock because he must catch a train. Time will be very limited.

Do you have other questions, Mr. Ikard?

Mr. IKARD. No.

Mr. RIEHLMAN. Mr. Lantaff, do you have any further questions?

Mr. LANTAFF. No.

Mr. RIEHLMAN. Mr. McCormack?

Mr. MCCORMACK. No further questions.

Mr. RIEHLMAN. I think in supplementing what you have had to say here today, we would like to give you an opportunity to read the record as it has been made, making any corrections that you would like to.

Dr. VON NEUMANN. I would very much appreciate it. I surely have forgotten some things. I would also like to make some stylistic revisions.

Mr. RIEHLMAN. That would be very helpful and there might be some additional remarks that you would like to add to those that you have already made. That would be very helpful to the committee on this project.

As you are revising your remarks, I would like to have you keep in mind that this is an executive session, which you understand, and if the committee should make up its mind at some future time to make the hearings public, we want you to have that in mind when you are revising your remarks. I wouldn't want you to strike anything, but if there is anything that you would care to have deleted from the printed record, you could make a notation of it.

Dr. VON NEUMANN. Yes, unless otherwise marked, this may be included in your publication. If any part of it is not so, I will make such notation.

Mr. RIEHLMAN. Very good, and we would not want you to hesitate to give us additional information that you would think would be helpful that you would want to mark "secret," and not to be put in as a public record.

Dr. VON NEUMANN. Yes.

Mr. RIEHLMAN. I know that you are on some important committees at the present time, and I wonder if you could tell the members of the committee the organizations on which you are serving at the present time.

Dr. VON NEUMANN. With respect to this matter?

Mr. RIEHLMAN. Your activities regarding research and development.

Dr. VON NEUMANN. I am not now, and I have never been full time in the Government service, although during the war I spent practically all of my time in bits and pieces of various Government jobs, but I have essentially been a consultant. What I have been telling you here is not entirely "from the inside", it is perhaps half "in" and half "out." I probably spend now 20 percent of my time on Government work as a consultant.

I am a member of the General Advisory Committee of the Atomic Energy Commission.

I am a consultant of the Los Alamos Laboratory of the Atomic Energy Commission, and recently also of the Livermore Laboratory.

* * * * * * *

I am a member of the Scientific Advisory Board of the Air Force, and the chairman of one of the panels of this board. * * *.

I am also a member of the Scientific Advisory Committee of the Ballistic Research Laboratories of the Army Ordnance in Aberdeen.

I am also a member of Mr. Quarles' Technical Advisory Panel of Atomic Energy.

* * * * * * *

These are the essential ones.

Mr. RIEHLMAN. I think we will have to excuse the doctor, and we deeply appreciate your coming down here and giving us this information.

Dr. VON NEUMANN. Thank you very much, sir.

Mr. RIEHLMAN. The committee will stand in recess at this time, and will reconvene at 2 o'clock this afternoon in the same room.

(Thereupon, at 11 a. m., the committee took a recess until 2 p. m., the same day.)

AFTERNOON SESSION

Mr. RIEHLMAN. The committee will come to order. We are very happy and pleased to have Dr. A. G. Hill with us this afternoon who, as I understand it, is director of the Lincoln Laboratory at Cambridge, Mass. Is that right?

Dr. HILL. We really should say Lexington.

Mr. RIEHLMAN. All right; Lexington.

Doctor, you have certainly had some information about the committee's interest in this great field of research and development. You have had an opportunity to observe the questions that have been sent out to you and to other scientists and to other people who are interested in this program.

It is my understanding that you have a statement that you have presented to the committee. Do you want to read that into the record or would you rather just have us glance through it and you speak extemporaneously from it?

Dr. HILL. I think the second.

Mr. RIEHLMAN. Extemporaneously. All right, fine. We would be delighted to have you proceed.

Dr. Hill.

STATEMENT OF DR. A. G. HILL, DIRECTOR OF LINCOLN LABORATORY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, LEXINGTON, MASS.

(Prepared statement of Dr. A. G. Hill is as follows:)

STATEMENT OF DR. A. G. HILL, DIRECTOR OF LINCOLN LABORATORY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, LEXINGTON, MASS.

The questions and problems which were brought to me are, I believe, very important to the work of this subcommittee. I shall not attempt to answer the questions nor to suggest solutions to the problems in any particular order, but rather hope that my general statement will touch upon many of the points which the subcommittee has raised.

In any organization, be it military or civilian, it is well to keep in mind the differences between organization and administration. Many of the faults that I have seen in research and development establishments often stem from pure administrative procedures rather than any fundamental flaw in the organizational structure. For research and development to be carried on at high efficiency it is necessary to establish an environment which is compatible with the best interests of the best type of research staff and to administer the day by day tasks with wisdom and quite often forbearance.

The organizational structure necessary to accomplish this must be very flexible and must anticipate changes in procedural matters to allow for changing situations and to allow for a good esprit de corps between the administrative staff and the technical staff. I have seen civilian organizations in which the administrative staff was drawn entirely from nontechnical parts of the parent organization. In all such establishments many of the same criticisms leveled against military research establishments were quite valid. Nevertheless, in a good civilian research organization it is necessary to mingle the operational people very closely with the research people. This makes not only better mutual understanding but it insures that the research people are working on problems important to the operational people and that the operational people realize the capabilities of the research staff in aiding in the solution of operational problems.

All of our military organizations rely to a profound degree on technical developments and technical devices. It is the purpose of the research and development establishments to insure that the best technical devices are introduced into the field forces at the earliest possible date and as a corollary that our tech-

nical equipment for waging war remains ahead of that of potential enemies. (This is a simple restatement of Stonewall Jackson's famous principle.)

No military research and development establishment staffed only by civilian technicians and military personnel whose background has been solely administrative can possibly do this job. Neither can an establishment made up solely of operational officers be abreast of the technical possibilities which can improve their operational capability. The proper solution in my opinion requires an intermingling of the various types.

I am not fully aware of the public laws and the military regulations which bear on the organization of research establishments within the military departments. It is my opinion, however, that many procedures and customs have become time honored and should be replaced by more realistic and up to date methods.

On the other hand I have often seen poor administrative procedures carried out by the military unit charged with the responsibilities of the research establishment which tend to inhibit and obstruct the flow of technical developments which could be useful to the military. Quite often officers assigned to an administrative duty have so little knowledge of the technical problems that they are apt to administer for the sake of administration. Parenthetically, I have seen the same problems arise in industry whenever the fiscal or the sales department is put in charge of the development groups.

In your first question you ask are there characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development. I believe the answer is yes but I also believe it would not be difficult nor upsetting to the present military organizations to correct this.

Your second question asks if the military organization tends to create conditions which retard the work of scientists and make it difficult to keep highly qualified technical personnel. Here I believe it is not so much a matter of organization as a matter of administrative procedures. In many military research establishments the senior civilian personnel feel that they are being treated as second-class citizens, for example. This could easily be remedied by a little administrative give and take.

Your third question asks whether a civilian organization for administration would be desirable. I believe that a civilian organization could well exhibit as many faults as the present military organization. It is my feeling as stated before that we need the mixing of the military operators with the technical people to insure the best overall program.

Your fourth question has two parts. The first relates to the separation of the military support functions from the technical activities. I believe such a separation will be desirable under some circumstances and not under others. I do not believe hard and fast rules apply here. The answer to the second part of the question again I feel depends upon circumstances and I think I could elaborate on this by example in my verbal testimony.

Your fifth question, I think you realize, is a very weighty one and difficult to answer quickly. I believe the present budgetary division between Government institutions, nonprofit institutions and industry is probably a pretty good one. For reasons stated above, however, I believe that in all cases the technical personnel could be brought closer to the operational military problems.

The above I hope gives you briefly my personal opinions on the extremely important matter presently before you. I shall be glad to expand on this in any way during my meeting with you.

Dr. HILL. I should start out by apologizing for the statement I sent you. I have not been in my office more than 2 hours since I got your questions and I dictated this statement hurriedly on Sunday. I tried to make a point which I do not think I quite succeeded in making, which was that although there are problems imposed on the military, perhaps from outside and perhaps from themselves, which make their problems of the administration of research peculiar or, let us say, different from industry and universities, still many of their problems you can find also in universities and industry.

I was trying to make the point that to the best of my knowledge there is not a great deal in the military organization that would have to be changed in order for them to do a more effective job. But when

it comes to the day-by-day administration, I feel that there is a great deal of room for improvement.

I want to specifically restate that this can be said of other organizations, not just the military.

Mr. RIEHLMAN. May I say, Dr. Hill, that we would like to insert in the record your statement, if it is agreeable to you, with the understanding that when you have completed your statement before the committee here today we will furnish you a transcript of it and give you an opportunity to elaborate on any of the points that you have made, with the further understanding that if there is anything that you would classify as top secret, you will note it when you reread the transcript. Although this is an executive session, we may feel at some later date that a great portion of the hearings might be made available for the public.

With that understanding, we would appreciate your reviewing carefully what you have had to say before the committee and elaborating on it. Anything that you feel should not be made public at any future date, you just mark it and we will see that that request is carried out.

Dr. HILL. Very good. Also, if I do tend to say anything that is classified, I will try to tell you at the time.

Mr. RIEHLMAN. That is right, and we will mark it as such in the record and it will not ever be made available for public use or information.

Dr. HILL. How would you like to proceed? Would you like me to elaborate on your questions?

Mr. RIEHLMAN. I think that it would be very helpful if you would proceed along that line and I think that is what you have tried to do in your written statement.

Dr. HILL. With regard to question No. 1; are there any characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development? As I read that initially I did not think of characteristics so much as, Are there any rules and public laws? and so on, and my answer is that I do not think there is any reason why the military as set up by Congress cannot effectively carry out research. There are certainly inherent characteristics that tend to inhibit them to some extent.

Mr. RIEHLMAN. Will you elaborate on that as you come to it, please?

Dr. HILL. Yes, sir. First of all, I think the average military man is trained to do a great many jobs. The military feel that to be a proper officer you have to have background in a great many staff and line jobs so that at any point you can take command with a complete knowledge of the system, how it works, what the task at hand is and how to get it done. I cannot quarrel with that at all.

It does mean, however, that quite often those people assigned to a research administrative post are not qualified for it in any way in background or otherwise. They then must either make decisions which are not in the best interest of the research and development program or else they must assign their responsibility to more permanent members of the organization or to other officers who might be well qualified to follow it up.

Nevertheless, although this is a hindrance, I have seen many military organizations operate very well. I do feel that in order to run any type of establishment of research and development, or a manufacturing plant, or a purely military establishment, it is necessary that there be created an environment in which the man who is to do the job, the working-level man, feels that he knows exactly what his job is and that he has the tools to carry it out.

I would like to give an example.

The Bell Telephone Laboratories, I believe, is about the largest organization of its type in the country. That laboratory has about 8,000 people, and perhaps 2,000 technical people. They do a great variety of research and development, all the way from very basic research to that pointed toward the development of new instruments for the telephone system, and indeed they are designing tools for the Western Electric Co. No matter where you go in that organization, you get the feeling that everyone there is interested in the art of communications and, in general, they feel they have at hand the implements to do the job.

I have seen some other organizations where the people were imbued with the idea that they were there to advance knowledge or that they were there to make a gadget, but at no time did they have the feeling that they were there to advance the cause of the parent organization of which they were a part.

Sometimes one finds both states of mind in the military research and development organizations. This is one, I think, that can be cured by wise management, not by public law or by organization.

It is true that if there are too many changes in management, too frequently—and this does happen more in the military than in most civilian organizations—it does tend to be an unsettling thing.

There is also a specific problem I would charge the military with here. They have a very elaborate supply, stockroom, spare parts system. This system is ideal in an operation where their job is to maintain a stock of F–86 interceptor parts. You can order the spare parts 6 months in advance and you can get them and they will be there. You cannot do that in research and development. If you did that, you will find that you will be doing the wrong thing because generally within 6 months the research and development is bound to change because they are certain to learn something in that 6-month period.

This may sound foolish but a good deal of the problem of making Government laboratories more efficient could be accomplished by these administrative procedures of how to order spare parts and how to stock stockrooms and how to buy things.

There is another problem which tends to, I think, hurt morale in a laboratory. Let us take a laboratory where the people were imbued with the idea that their job is to improve the Air Force in some way or another. If they feel this way, then they know perfectly well that the research and development is not the goal. It is the finished article in the hands of the user and, until that is accomplished, they have no purpose in life. They serve no useful purpose.

Now, what has happened quite often is that after a good deal of research and development, either within the structure of the military or perhaps contracted somehow, a design, a prototype is made and then one must get into the hassle of letting bids. Quite often the

wrong people make the low bid and it is very difficult to prove incompetence on the part of a low bidder.

I don't know how this can be improved but it is a very tough one and I have seen it happen on many occasions. Quite often, when a low bidder who is incompetent gets hold of a contract, nothing much comes out for a while and this is very disturbing to the whole program, not only to the military but to the men who developed it.

I don't know the best answer to this problem, and it is certainly a tough one. It is very important, however, that contracts on new, difficult, and important military items be awarded only to the competent contractors. If this is not done, not only does the military user suffer, but the morale of the developing agency is greatly decreased.

Mr. BALWAN. The question that I have on the first part is an observation that the Air Force, in deciding to develop a system of continental defense, had an organization called the Cambridge Research Center to which it did not assign the task of working out the problem. It went to the Massachusetts Institute of Technology, which formed a contract with the Air Force, and asked it to carry it out.

What characteristics are there about your organization which make it different and much more able to carry out those functions than the Air Force itself with a standing organization?

Dr. HILL. That is a tough one.

First of all, I point out when this decision was made, the Lincoln Laboratory did not exist. The Massachusetts Institute of Technology existed. Lincoln did not.

Secondly, that one member of the first group of Air Force people who called on us and asked the Massachusetts Institute of Technology to undertake this problem was the then civilian technical director of AFCRC, and I mean Mr. Marchetti.

Mr. BALWAN. He called on you?

Dr. HILL. Oh, yes; he was a party to this. He thought this was the right approach. He told me that he did not feel that Cambridge, with its then present tasks and with its inflexibility, which is somewhat inherent within a military organization, and somewhat inherent within a civil-service organization, could do this job effectively. There were other reasons.

There was the history of the radiation laboratory at the Massachusetts Institute of Technology during World War II which, whatever its faults, did prove that it was able to move quickly and to do tasks that other organizations have taken a much longer time to do.

There were 2 or 3 other reasons for coming to the Massachusetts Institute of Technology. At the end of the war the radiation laboratory was terminated.

Mr. BALWAN. That was a part of OSRD?

Dr. HILL. That is right. It was a "for-the-duration" type of operation. The military services, and I think there was great wisdom in this, continued programs of basic research at the Massachusetts Institute of Technology and at various other places—Harvard, Illinois, Stanford, industrial establishments, and many others. It did continue a program of basic research in fields of interest to the military, vital to the military.

There was a cadre of people at the Massachusetts Institute of Technology, the digital computer laboratory, which had operated,

interestingly enough, under a Navy contract and the research laboratory of electronics, which was under a three-services contract.

So that there was a body of people and knowledge to be called on. There was another reason and that was the existence of the Scientific Advisory Board of the Air Force. They had, shortly after the explosion of the first Russian atom bomb in 1949, assigned to one of their panels the task of looking at air defense, and the chairman of that panel was Dr. Valley, a staff member at the Massachusetts Institute of Technology.

His group had come up with a set of recommendations about the use of automatic machinery and the like. So for air defense, the Massachusetts Institute of Technology seemed a natural. They had this group under Dr. Valley which had pointed out the necessity for this type of device.

Thirdly, they had the research laboratory of electronics with a great deal of background in radar and communications which was germane to the problem.

That is a very lengthy answer to a short question but I do not see how I could have given it in less time.

Mr. BALWAN. It appeared that a lot of reasons for putting this project under a contract with the Massachusetts Institute of Technology themselves pointed out weaknesses in the military system for doing these things.

Dr. HILL. That is right.

Mr. BALWAN. My question, and I hope this is not a leading one, is can we expect anything more from the Air Force in their research and development than to keep a kind of competence and qualitative control over their outstanding contracts?

Dr. HILL. I think a bit more than that. Lincoln is a rather vast enterprise and, of course, the defense of continental North America is, in itself, a vast enterprise. It was simply not in the AFCRC.

You say couldn't you have added more? And I think you are getting very close to the heart of the whole problem. With present civil-service regulations and operations, it would have taken a great deal longer time to have added people at Cambridge than to get them through private contractors.

There is an inherent inflexibility in the civil-service setup that can be avoided by going to a private contractor. That is perhaps a dangerous thing to say to a body of lawmakers. But to establish the need for a job, one has to go through a very lengthy clerical procedure which is very arduous. To establish salaries is very difficult, and the salary scale, although I think quite good at the lower level shortly after the war, has always been bad at the upper levels and whether it is still good at the lower levels, I don't know.

There is another thing. The average technical person, I think, will in general prefer work in industry or at a university than to work in a civil-service-laboratory.

Mr. RIEHLMAN. You say that is pretty generally held as an opinion?

Dr. HILL. I think so. It is very dangerous to generalize for a large body of technical people.

Mr. BALWAN. Can't some of those inducements be brought into a Government laboratory?

Dr. HILL. Oh, surely.

Mr. RIEHLMAN. By what means.

Dr. HILL. First, let me add quickly that there are a great many very good people in Government laboratories. Obviously, it is not impossible to get them.

Mr. BALWAN. But not enough in this case?

Dr. HILL. That is right; not enough and it is very hard to increase the size of an organization quickly. It is just very difficult and I have never understood why that is, but I do know it is so.

I think there is another problem and this may be not inherent to the military at all. It may be true in any organization.

If you are suddenly confronted with a brandnew job, you often find that during the course of establishing—let me go back a little. One has a stable organization that might be called General Motors or something else and this organization has prospered for years by certain standards and devices and procedures and so on. Suddenly they discover they have to make something entirely new, go into a completely new field. They then have to make the decision whether it is better to try to fit this new field into their present organization, or to reorganize, or to start a new company, so to speak, in a corporate sense. Quite often it is this latter decision that is made. It is better just to start afresh a new organization and I think that was, in part, one of the overriding decisions in putting Lincoln at an outside contractor.

I should hasten to add that industry also was considered for a project such as Lincoln. To succeed, there are several things necessary but two of the most important are that the project have access to the management of the armed services, and that it doesn't work through some eighth echelon affair where it is never heard at the top.

Mr. BALWAN. Is that the case at Cambridge?

Dr. HILL. Yes; it would be much more difficult because they have to work through channels.

Mr. BALWAN. They have to go through ARDC before they can go to ADC?

Dr. HILL. That is right.

Mr. BALWAN. ADC being Air Defense Command.

Dr. HILL. Yes.

Secondly, it must be a disinterested party. If M. I. T. were in the electronics business and had this key post in electronics, which is a big industry, it would be very bad if we were somehow competing with the people we also had to go to for assistance.

I think Du Pont, a chemical industry, could run it but not General Electric. A vice president of G. E. said it would be crazy to put a project such as Lincoln at General Electric or any other electronics manufacturer. They have to be disinterested.

Certainly AFCRC is disinterested but you indicated this one other point, they do not have the access or the ability to hit the right people on the right problems.

Mr. BALWAN. Just before that, we asked what are some of the inducements which exist in your organization to bring in enough manpower of the quality you are talking about to provide the outcomes which we want.

Dr. HILL. Let me say that we have had a great deal of difficulty getting topnotch people.

Mr. BALWAN. Even at the Massachusetts Institute of Technology?

Dr. HILL. Even at the Massachusetts Institute of Technology. We have, of course, felt that we should not compete with industry even in the matter of salaries and our salary scale is a bit low. It is more flexible than civil service but it is no higher except at the very top levels. It is a little higher, but not much. It is nowhere near comparable with industry at the top level.

I do not mean to speak feelingly on this at all. There are, of course, attractions. There is a community of science at the Massachusetts Institute of Technology that other scientists like to join. There is a feeling at the Massachusetts Institute of Technology that you are a member of the family and you can mingle with the other members at all levels. It is a very friendly, cooperative thing and not a channelized, rigid thing. This is quite attractive.

To some of the younger people, the opportunity to take courses is always an inducement. They have some of these things at Cambridge, too.

Mr. BALWAN. It would seem to me that they have those inducements except that instead of having a Dr. Hill who is in charge of a project you have a general who is not a scientific man and with whom they cannot identify themselves on the project in carrying out their career.

Dr. HILL. I think if they knew General Maude, they would find him quite as accessible as Mr. Hill.

Mr. MCCORMACK. Whose fault is it if they don't know General Maude?

Dr. HILL. I was speaking of somebody out in St. Louis to whom an offer is being made, who doesn't know General Maude. If they are already at Cambridge and don't know General Maude, then it is either their fault or General Maude's fault. But I think there is a little different feeling. Civilians sort of like civilians and the military like the military and this is human nature.

Mr. BALWAN. Isn't it possible, and this is in the realm of the hypothetical, to have a Cambridge Research Center with Dr. Hill in charge of it, still being a Government organization which would provide almost the same inducements that you have in the neighborhood with a community of scientists? They could take courses and have the support function provided from a different base much as Cambridge provides the support function to Lincoln separately, without being an integral part of Lincoln.

Dr. HILL. I think it is quite possible. I do not see why it could not be done. I am not sure it is the whole answer.

Mr. MCCORMACK. Are you satisfied that we are getting the maximum results for the money invested?

Dr. HILL. In Cambridge?

Mr. MCCORMACK. No, in our research and development.

Dr. HILL. I am quite sure we are not. I had, of course, better amplify that one quickly. There are inefficiencies in every organization.

Mr. MCCORMACK. I understand that, of course.

Dr. HILL. So if I can rephrase the question, is the taxpayer getting as good a deal as, say, the stockholder of corporation X?

Mr. MCCORMACK. I wouldn't apply it as strictly as that.

Is the relationship between the military and the technical staff, the scientist and the technical employees in the military field such that

there is that partnership state of mind and understanding state of mind based on respect for one another, that we are getting the maximum results for the money we are spending?

Dr. HILL. No. But you put your finger on a very important problem and this has to be improved and that by wise management.

Mr. MCCORMACK. You say it has got to be improved by wise management. Of course, that takes into consideration many factors. You have two groups about as opposite, one to the other, as any two groups of human beings can be, the military that, of necessity, are disciplined and the scientists who are searching for new discoveries and truths and he is very individualistic minded. Is that a fair way of saying it in a broad way?

Dr. HILL. Yes, sir.

Mr. MCCORMACK. While there are complicated difficulties among human beings, among groups where you are working together, nevertheless, you have two groups so peculiarly minded as a general proposition by training, study, and their life's careers that it requires more than the ordinary amount of judgment for the manager, so-called, whether he is military or civilian, to have them work together with a maximum of success. Is that a fair statement?

Dr. HILL. Absolutely.

Mr. MCCORMACK. Our whole research program in the first instant is dependent upon what those men in basic research discover, isn't it?

Mr. HILL. Yes, sir.

Mr. MCCORMACK. So, without minimizing at all the importance of applied production, managers, the concept of all others, technical and nontechnical, who are part of the picture, the beginning, the origin is in basic research of new discoveries.

Dr. Hill. Yes, sir.

Mr. MCCORMACK. So, everything that possibly can be done to resolve these irritating difficulties that develop everywhere, and we have it in all our lives, but which are more prone to develop sharply among these two honest-minded groups, but divergent groups, should be done. That requires all the skill and the tact possible.

Dr. HILL. Yes, sir.

Mr. MCCORMACK. Under our research and development as presently constituted, the military plays a part in this organization where it administers the primary part.

Dr. HILL. Yes, sir.

Mr. MCCORMACK. So the skill and the tact must come from there, is that correct?

Dr. HILL. Absolutely.

Mr. MCCORMACK. It must originate from there. The skill and the tact must be cooperated with their responding among the scientists and the technical staff.

Dr. HILL. Yes, sir.

Mr. MCCORMACK. We are trying to do something constructive here where we get the maximum results for the national interests of the United States. We are all interested in that. We all realize our own human frailties but we are trying to get the greatest strength in a system that will produce the maximum results humanly possible.

If a military man has technical experience and technical knowledge, he is respected by the scientist and the technical members of any team. That is right, isn't it?

Dr. HILL. Yes, sir.

Mr. MCCORMACK. If a military man hasn't got it, of course that does not make him as effective a manager as if he did have it. I would assume so. Is that correct?

Dr. HILL. Very nearly, if I may modify it a little.

Mr. MCCORMACK. Yes.

Dr. HILL. I would say the prime requisite is intelligence and understanding. I know I could work perfectly well for an officer whose intelligence I respected and who I felt respected me and understood what my problems were.

Mr. MCCORMACK. But wouldn't you work better with a man whose intelligence you respected and who had an understanding mind but whose intelligence in your field you respected?

Dr. HILL. That would be an improvement.

Mr. MCCORMACK. But if a man is intelligent but not intelligent in this particular field which is highly specialized to the extent that he is lacking in the intelligence, the ability to pass upon a technical question, he has got to lean on somebody else, isn't that right?

Dr. HILL. That is correct.

Mr. MCCORMACK. That is true of any walk of life. So you could have an intelligent man in the field of military tactics but he wouldn't be intelligent in the field of research and development, necessarily, intelligent in that field. It would take him a long period of education.

Dr. HILL. That is correct.

Mr. MCCORMACK. Have you any opinion as to whether or not, within the military, they could develop officers who, through their career and by reason of their background, are capable of assuming these positions of responsibility and trust in the field of research and development?

Dr. HILL. I certainly think they should. I hasten to add I think they do. I feel there perhaps are not enough top jobs in any one of the three services for the technical specialists, the career technical officer.

Mr. MCCORMACK. Well, that is a matter of organization.

Dr. HILL. Yes, sir.

Mr. MCCORMACK. So you talk about administration but that is a matter of organizational effort, recognizing the importance of this, keeping men in a sort of line of continuity of study and experience and holding forth for them the opportunity of advancement in the military which is, of course, an important thing in the minds of all of us.

Dr. HILL. Yes.

Mr. MCCORMACK. What do you think about rotation? Do you think the officers should be rotated every 1 to 3 years?

Dr. HILL. I would think 1 year in any type of job is, in general, too short. Three years, I would think, is better for most line jobs. In a purely technical job where a man is a technical career officer, I would think maybe 3 to 5 years would be more proper.

Mr. MCCORMACK. And if he is transferred, it should be in some related activity.

Dr. HILL. Yes, sir.

Mr. MCCORMACK. From which he could get broader experience and knowledge and come back and assume any higher position.

Dr. HILL. Yes, sir.

Mr. McCORMACK. This morning we had Dr. Von Neumann. You know him, do you not?

Dr. HILL. Yes, sir.

Mr. McCORMACK. And we asked him about this matter of 2 years. He said the first year he is learning and the second year he is preparing his papers to leave. I thought that was quite original and a natural. Would you disagree with that?

Dr. HILL. Not sharply. I think 2 years is too short a time.

Mr. McCORMACK. In any event, there should be a continuity. I might say that you are not alone in that thought. There is disagreement, but among the military some of them realize the importance of that.

In considering this matter, it has got to be considered in the light of the mental thoughts and dispositions of the important groups that make up the team and the threat to the world and the emergency that confronts us.

Dr. HILL. I agree with that.

Mr. McCORMACK. Having always in mind the national interests of our own country.

Dr. HILL. Yes, sir.

Mr. McCORMACK. Now, a scientist is very quick to sense and resent domination, is he not? I might say I am myself. I am just an individual.

Dr. HILL. I suspect so.

Mr. McCORMACK. But I mean as a group they are. There was not much difficulty in having this team work during the war, was there?

Dr. HILL. None whatsoever.

Mr. McCORMACK. And it can be done now?

Dr. HILL. I believe it can be.

Mr. McCORMACK. And there has been something that disturbed it?

Dr. HILL. Yes, sir.

Mr. McCORMACK. And that disturbance has not been for our best interest. I am not criticizing any one individual, maybe both sides, but something can be improved on.

Are you satisfied with that, Doctor?

Dr. HILL. I agree with that.

Mr. McCORMACK. I will ask about something that you were a co-author with President Killian of the Massachusetts Institute of Technology, and while it is related to a little bit separate subject, if any of the other members have any questions to ask, I will defer at this time.

Mr. RIEHLMAN. Do you have any particular questions at this time, Mr. Lipscomb?

Mr. LIPSCOMB. You spoke of a line job. What did you mean by that?

Dr. HILL. I was referring to Navy terminology. A line job is essentially with the fleet or in charge of a bureau. A staff job is one of planning and programing and getting the budget prepared.

Mr. LIPSCOMB. But a line job would not be a technical job?

Dr. HILL. No, not in general. It might be, but not in general.

Mr. LIPSCOMB. Is there much difference at this time between the salary scale at Lincoln and that at Cambridge?

Dr. HILL. This is a difficult question to answer. I think way down at the level of about the third level down and below, there is probably

no difference. Cambridge might be a little higher in spots. I suspect they are about the same.

Mr. LIPSCOMB. Do Government laboratories offer as much incentive as a commercial laboratory?

Dr. HILL. They offer a different incentive. If you take a young man beginning a career, I think there is strong incentive there but if he thinks about how much money he might be making 15 or 20 years later, there is more incentive in an industrial job in general at the higher levels.

Of course, this implies that the young man is going to be one of the 10 percent who might get up to the high levels. I think there is a good deal of incentive offered in Government service.

Mr. LIPSCOMB. You mentioned that even your laboratory is having trouble getting technical people.

Dr. HILL. Yes, sir.

Mr. LIPSCOMB. And also Government laboratories. Are other commercial laboratories having trouble at the present time because of lack of qualified technical people?

Dr. HILL. I believe, in general, there is still a shortage of technical people, so all places are having some difficulty. We are having more difficulty in two ways, one in not being able to offer enough salary incentive to high-level people. We are endeavoring to correct that, and, secondly, in not being able to borrow people from other universities, and I think this hits some of the points you raised, Mr. McCormack.

During the war, any scientist at all, when asked, would go to work on anything for the war effort or even just before the war started. All universities cooperated gladly in lending people. This was, of course, to their benefit, because they did not have any students, but in spite of that, and even before there was a complete lack of students, they collaborated in lending staffs to the radiation laboratory effort, the group at Harvard, the group at Los Alamos. Those were, in general, staffed by university scientists on leave.

We do not have the same feeling nationally or among the presidents of our sister institutions nor among the scientists nor among the people of the United States, or even among some of the military. We do not have the same feeling of urgency and the sense that something must be done. This is the really great hazard. It is my feeling we should have 30 people, topnotch men on leave from the universities.

Mr. LIPSCOMB. The urgency exists. Why don't we have that filter down to the people?

Dr. HILL. This I cannot understand.

Mr. RIEHLMAN. You just made the statement that you should have 30 leading people from these universities. Has there been any attempt made to get them?

Dr. HILL. There was a very strong attempt made 3 years ago. There have been some smaller attempts made since. I believe that 3 years ago many of the presidents of some of our sister institutions looked upon us with some suspicion. We had taken this contract and attempted to lift away their scientists. That is not so true now.

Mr. RIEHLMAN. Would the contracts that we have with many of these leading institutions throughout the country have any effect?

Dr. HILL. Oh, yes, that has quite an effect.

Mr. RIEHLMAN. I wondered if that might not be quite effective, because they probably feel that as long as they have the contract, they need their people in the research and development program right in the university.

Dr. HILL. That is correct, but still many of these contracts are for long-term programs. It is my feeling that we have to divert a few people.

Mr. RIEHLMAN. You have some knowledge of this; do you feel that the institutions are equipped with enough people that they could give the Government at least 30?

Dr. HILL. Well, I was thinking of 30 for the Massachusetts Institute of Technology alone.

Mr. RIEHLMAN. That is what I am talking about.

Dr. HILL. I would say maybe 300 is what we need.

Mr. RIEHLMAN. Across the Nation for the research and development program, but in your own institution, there is no question that they could be made available without hindering any activities that the universities are engaged in?

Dr. HILL. It would hinder a bit, but I would think it would have a salutary effect on the Nation as a whole. It would not wreck the basic research program of the country.

Mr. RIEHLMAN. You feel it would bring about the feeling of urgency that you have been talking about to promote this research and development program?

Dr. HILL. Yes, sir.

Mr. MCCORMACK. Didn't Dr. Killian make an address in which he expressed some concern about the overemphasis of contract work in the university and the danger to the primary purpose?

Dr. HILL. I believe he made an address of this sort about a year ago and he was severely criticized by the Boston Post, but they later retracted it.

What he said was that he would be extremely happy when this contract for research and military weapons could go. What he meant was when we had a peaceful world, and not that the Massachusetts Institute of Technology wanted to get rid of it in this emergency.

Mr. MCCORMACK. I thought he made some such address more recently than that. I am a great admirer of Dr. Killian's.

Dr. HILL. I don't recall the more recent article.

Mr. MCCORMACK. Supposing that is so, how does that reconcile itself with your answer to the chairman's question that if you put more and more contracts into the universities, the responsibility of performing them and carrying them out and its effect upon university life would be serious?

Dr. HILL. I will have to back up a minute for this one and make sure I say what I mean.

Since the war the military services have contracted a great deal of basic research to universities. I think this has been the lifeblood of the scientific effort of this country. I just think they were very wise and very smart in doing this. This contracted effort is very widespread among the leading universities of the country.

Times have changed a bit since 1945 and 1946. It is my feeling that if a few of these basic research programs did not go along as fast or were even curtailed, some of the small ones, $10,000 a year and so

forth, if some of these were curtailed and the people were brought into a center dealing with the day-by-day military problems, we, as a country, would be further ahead. I do feel that this basic research effort has been a wise one and it has led to the creation of a great many young scientists. I mean they have been educated through these research programs. It has been very wise. It should continue without overall budgetary curtailment, in my opinion.

However, I think there are a few people who could be abstracted from the program and not slow it down, but put them into more urgent fields.

Mr. McCormack. I was not trying to argue with you but to say, if my memory was correct, that there was an address made by Dr. Killian which I read very closely, as I do everything he says. I read not only what he said but I like to read behind the lines, what he doesn't say but would like to say.

Dr. Hill. I do not recall this recent one.

Mr. McCormack. But he seemed to express concern that the emphasis on education was being diverted into the carrying out of the contracts made with the Government.

Dr. Hill. I am just not familiar with this one. Perhaps I can answer it another way by saying that if I were Mr. Killian I would be very concerned about that, but would not change it. I would make sure that I was so concerned that the military effort did not hurt the educational effort and vice versa.

Mr. McCormack. I cannot conceive of him doing anything than that which is for the best interests of our country.

Dr. Hill. I cannot conceive of anything else. I want the record to show that.

Mr. Riehlman. Do you have any other questions, Mr. Lipscomb?

Mr. Lipscomb. I am interested in this urgency. You indicated that some of the work being done at the universities is not as urgent as some of the work that is actually necessary.

Dr. Hill. That is correct.

Mr. Lipscomb. There is some effort that should be made, you think, to narrow our field that we are doing our research in, not relating to the educational efforts but to bring it to a point where we are doing these urgent jobs more rapidly.

Dr. Hill. The point I tried to make was that we could pull a few top people out of basic research programs without hurting them, but at the same time giving a tremendous lift to the applied.

Mr. Riehlman. This morning Dr. Von Neumann was before us. In interrogating him, we got into the field of research and development in Germany in the last world war and he made this statement, that they had so many projects under consideration and they were so disorganized, they were not successful in some of the projects that they could have practically won the war with, had they concentrated on them.

I am wondering if we are not somewhat in that position. Do you have any thoughts on the subject?

Dr. Hill. Yes, sir.

Mr. McCormack. Might I read from what you and Dr. Killian wrote on that subject?

Dr. Hill. Yes, sir.

Mr. McCORMACK. In World War II, and this is the article which I placed in the Congressional Record as of April 28 of this year:

In World War II, the Germans gave a convincing demonstration of failure properly to utilize the resources of science and of a cultivated incompatibility between military planners and scientists. We should diligently seek to prevent such a catastrophe in the United States.

Dr. HILL. I still believe it. I would like to expand on the chairman's question a little.

Mr. RIEHLMAN. Would you, please?

Dr. HILL. Basic research is a funny thing. Prior to 1930, a good professor, with 2 or 3 smart graduate students, could do a tremendous job toward advancing knowledge. As high-energy physics came along, the opportunity of teamwork entered into it. Now, there are some fields that are just as basic research, but they require a tremendous machine which requires a lot of people to work, and then you have a lot of professors and students working on it.

But, in general, basic research as such doesn't have to be in a big organization and doesn't require a lot of teamwork.

When one gets to applied research for the military, one finds that if one parcels out a little piece of the problem here and there, you don't get anywhere. This is what the Germans did. The German atomic-bomb development was parceled out and compartmentalized and nothing happened.

You have to build an organization large enough to reach critical size. You take plutonium and it is perfectly safe until you get it to a size where it is critical and then it is a very different entity. The air defense of the continental United States is one such problem. You could not possibly do it by compartmentalizing into a lot of bits and pieces. It is what the Air Force had done prior to the establishment of Lincoln and this is another reason for the establishment of a central laboratory which could get into new fields.

For instance, Lincoln does not do a darn thing about design of interceptor aircraft or of guided missiles, which are extremely important with us. But they are being done and they are separate entities. What we have to make sure of is that our system can work with them, so we keep very close touch with the aircraft manufacturers and the military operators of aircraft. But I think the important thing is that that you have an immense operation and you therefore must build a laboratory to go along with it that is large enough and competent enough to deal with the problem.

Mr. RIEHLMAN. Do you think we are doing that?

Dr. HILL. In some fields. I think development programs for air defense, and perhaps I will be criticized for boasting, is in pretty good shape.

Nevertheless although research and development in the field of air defense is now going along at a pretty good pace, it should be stepped up. However, the present effort is very deficient in capitalizing on the production of equipment.

We do not now have our backs in continental defense as a country.

Mr. RIEHLMAN. You feel that the basic research is sound and that they are producing for development items and changes that should be made in some of our equipment at the present time and that they are not getting the development of it as rapidly as they should?

Dr. HILL. That is correct.

Mr. MCCORMACK. Why is that?

Dr. HILL. Partly because I do not think there is enough money for Air Defense Command. It is my own feeling, and purely personal, that we need a bit more money in our whole military budget. I do not for 2 seconds say we could not spend our money more wisely. I am sure we could. But this is sometimes easier said than done. I do feel a bit more money spent wisely in all of our military effort, but especially in air defense, which is lagging behind or which was behind and which is just trying to catch up, would be very effective, and it might be a matter of several billion dollars or a couple of billion dollars for a few years. I am not talking about anything like $20 billion a year.

Mr. MCCORMACK. We have the facilities developed or capable of development, have we not?

Dr. HILL. Yes, sir.

Mr. MCCORMACK. I am going to ask some questions about this a little later.

Dr. HILL. I should like to add here that General Smith, who is vice commander of Air Defense Command, once stated that the amount of air defense this country could get was strictly proportional to how much we spent on it. With one limitation, I will agree with him. As you approach 100 percent air defense, which is probably unobtainable and not necessary, each increment costs a bit more. But we are still in the part of the curve where, if we doubled our expenditure, we would double or almost double the defense we have.

Mr. BALWAN. May I ask a question?

Mr. RIEHLMAN. Yes.

Mr. BALWAN. Is it not a part of that problem that there is a fear on the part of the offensive and retaliatory minded people in the military who believe that we should not develop a defensive psychology or even to train our resources in terms of manpower and scientific people to think in a defensive way? This morning we heard Dr. Von Neumann, who expressed the offensive thinking in terms of strategy that, even if our offensive capability were knocked out, 80 percent of it were knocked out, it should be so strong that the remaining 20 percent should be able to retaliate and provide fear in the minds of the offenders.

Might that not be one of the things which keeps us from having a sense of urgency in the project you are heading up?

Dr. HILL. There is no question that 2 years ago, I think most of the Air Force felt just as you did.

One, they thought there was just so much of a pie that you split up and, secondly, if you gave Air Defense more of the slice that you took a little bit away from SAC, I think that has changed somewhat. It is my own opinion that probably the Strategic Air Command and the striking force of the Navy ought to be increased too. But I do not quite follow the argument that all you ever need is just so much offense and the last few percent can beat the enemy.

Mr. BALWAN. Isn't it the matter of changing the kind of leadership in SAC where you have a General LeMay who imparts the sense of urgency and gets the money for SAC; and the same thing for the Atomic Energy Commission?

Dr. HILL. I have the greatest respect for Gen. Ben Chidlow, commander, ADC, and for Gen. Fred Smith, who is vice commander. I think that their task is harder than General LeMay's.

To begin with, in 1945 and 1946 we had the atomic bomb and the means of delivering it. So this was easy to sell. We had no air defense and no concept of it. These philosophies have started late.

Perhaps our program on air defense would be successful too if you had a supersalesman such as General LeMay, and I do not mean anything derogatory about this, but he is a supersalesman for the Strategic Air Command and he should be. It would be helpful to have such a man on the air defense side, acting as General LeMay.

There has been in the minds of a lot of people the feeling that you can do without defenses and somehow have the offensive power left, although you have given the enemy the chance to strike the first blow. Obviously, the first blow will not be at the Pentagon but at the SAC bases.

Mr. BALWAN. How effective a screen can be set up in keeping back the offensive striking power. In other words, for each successive increment of expenditure in Air Defense Command for the plan you are setting up, how much can you get in terms of reducing the percentage of planes coming through?

Dr. HILL. At the moment, I think if we doubled the expenditures, which we could not do overnight, we can appropriate the money overnight—but it takes a long time to build up that manufacturing potential.

Mr. BALWAN. Let us say over a 3-year period.

Dr. HILL. If you doubled it, you would darn near double the potential. I think this doubling would be a linear thing. That is for each increment of dollar you would have an increment of defense up to the point where we have 50 to 60 percent defense.

Mr. BALWAN. Is it possible to get that high?

Dr. HILL. In my opinion, it is possible to get well over 50 percent. I keep saying 50 percent for the following reason: say you have a 10-percent defense and the enemy wants to drop 100 bombs on target; then he has to send 111 bombers. Now, say you go up to 50 percent. That forces him to send 200 bombers over for 100 bombs on the target. If you get over 50 percent and go to three-quarters, then you have forced him to send over 400 bombers. So, if you get over that magic figure of 50 percent, you put the heat on the offensive because then they have to put in a tremendous effort to get a small attack through.

Let me say something about percent and what it means. If the best measurement indicates that 10 percent is possible—that doesn't mean that if 100 bombers come over that 10 of them will be shot down. It means that that is the most probable thing that will happen. It is also possible that 20 will be shot down or that none will be shot down. These are just laws of chance.

If you can get over 50 percent or 60 percent then it is perfectly well known to the enemy that there is a good probability that 90 percent will be shot down, and if 60 percent is your optimum figure, 90 percent isn't out of your sights. Then he will think twice about sending over bombers when he knows he will be retaliated against, and that there will be a strong offense left to deal with.

You asked me what can we get. I say things are now in the works which will give us more than 50 percent and some of them can be speeded up and some expanded to increase the percentage kill probability.

Mr. BALWAN. And there is a linear relationship between expenditure and percent of defense?

Dr. HILL. At the present moment.

Mr. RIEHLMAN. How long will it take us to get up to the 50 percent?

Dr. HILL. I am giving you only my opinion, that at the rate we are going, 3 to 7 years.

Mr. MCCORMACK. Mr. Gardner said 1959, didn't he?

Dr. HILL. He is saying 5 years. I said 3 to 7. Because some things might work a little better or worse than planned and some things might come a bit quicker. If they get slowed down, we may never get there because, obviously, as time goes on, both the offensive capability of an enemy and our own defensive capability will change. If we plan now for a defense against the TU–4's, the Russian version of the B–29, and plan to have it ready by 1959, we are just kidding ourselves because he is coming at us with B–47's or worse at that point. This is what makes it so hard to say, when do I think we will get it. I think the program could be such that we could get up to a real good probability by something like 1957 or 1958, 3 to 4 years, but we have got to push.

Mr. RIEHLMAN. Are there any other questions on that point?

Mr. MCCORMACK. You and Dr. Killian think that with the proper continental defense that the probabilities are that not more than 5 percent to 10 percent of the attacking planes might get through?

Dr. HILL. I do not recall that we ever said that, sir. I think what is important is getting it up as high as we can without getting to the point where we are just spending billions of dollars to raise it one-half percent or so. We are nowhere near that. I would not say that 90 percent kill probability is impossible, either. I don't know.

Mr. MCCORMACK. What could get through now with our defenses?

Dr. HILL. Anything, B–29's and jet bombers, missiles launched from submarines, all these could get through.

Mr. MCCORMACK. In other words, we have practically no continental defense?

Dr. HILL. No, that is not quite fair but I think that is probably a proper statement, but let us put it this way: If the Russians launched a medium-sized raid at high altitude with the TU–4's in the daytime, we would get most of them.

If they launched a 40-plane raid at New York, we might shoot down an awful lot.

If they launched a low-level attack at night against New York, we would get very few. Our capabilities are going up.

Mr. MCCORMACK. That is not the question. Are they going up fast enough?

Dr. HILL. Not in my opinion.

Mr. RIEHLMAN. What can be done in the field that we are interested in, in research and development, to implement it?

Dr. HILL. It is my opinion that the field of research and development in air defense is pretty good. It is not perfect by a long shot, but it is pretty good. I think that a general blessing from this committee might help a lot because we do have to fight for certain money

each year, like everyone else, and I think a general statement that no cut should be made, and that the military should consider some increase in the field of research and development for air defense would be extremely valuable.

Mr. LANTAFF. What was the status of the funds requested for research and development as the bill passed the House?

Do you recall?

Dr. HILL. No.

Mr. RIEHLMAN. Do you fear that there was a serious cut?

Dr. HILL. Not for the operation of Lincoln. I cannot say about how much was cut from the interceptor development and of guided missiles. I don't know. As far as I know we got about the amount of money we asked for.

Mr. RIEHLMAN. I think the committee could get that information.

Mr. MCCORMACK. You said in your article:

> We need to have placed before us the qualitative considerations which affect our policymaking.

Would you explain that?

Dr. HILL. I would have to refresh my memory as to what went just before that.

Mr. MCCORMACK. All right, Doctor, here is the article. You may do that.

Dr. HILL. What we meant there was that we felt that the people of this country, and I mean all of us, were not as well informed about the dangers facing us as we might be.

Mr. MCCORMACK. I should agree with that as a Member of Congress, because I am not. That is no criticism and I am not confining it today. In the last administration it was the same thing, and I say that to remove any thought of partisanship.

Dr. HILL. It has been my experience that a good many quite intelligent people simply do not want to believe that this country can be devastated by atomic bombs or hydrogen bombs. There is no question in my mind that it can and I know it is not in the too distant future and what will prevent it are a great many considerations, including the strength of the Strategic Air Command and the other services, but in particular air defense has to be pepped up, and I think one of the ways of doing it is letting the electorate of this country know the facts. Somehow or other they have not been informed.

Mr. LANTAFF. Of course, there are security measures involved which prevent to some extent the wide dissemination of that information, because your degree of vulnerability is of course pretty well classified.

Dr. HILL. That is correct.

Mr. LANTAFF. So that you always have to weight security measures against a question of dissemination of that information as widely as possible.

Dr. HILL. Nevertheless, there have been a good many articles coming out, and there was a certain one by General Vandenberg in 1950, in which he discussed this problem very frankly. There was a tendency on the part of a good many people to give the Russians very little credit for intelligence in the atomic energy field.

Now it is perfectly known and no longer classified that the Russians do have these capabilities and they are pretty darn good.

Nevertheless, I think a very authoritative statement by this Government would help a great deal and would not violate security.

Mr. IKARD. Don't you think possibly that a lot of the articles we read and see in the newspapers are in effect misleading about the different capabilities of this country, and I refer specifically to some of the guided-missile stories that were in every newspaper here a few months ago that made a lot of claims or left some impressions of false security.

Mr. RIEHLMAN. I think our own committee has had an opportunity in the past to observe the capability of some of our guided missiles, and we know that the information the public has is entirely different from what we saw with our own eyes.

Mr. IKARD. I think that approaches the criminal when you build a false security into people generally.

Dr. HILL. I think all of us like magic, and a guided missile is something so different from the things we knew in childhood it seems magical. Nevertheless, a guided missile has only a certain chance of being fired at a bomber, and if it is fired, it has only a certain chance of hitting, but there is a time delay between the time you fire this one and the time you fire the next one. So out of 5 bombers, 4 may get through.

These guided missiles are not cheap, and you cannot cover the countryside with them. Let me say that the introduction of NIKE isn't magic. It is a very hard and sweaty job of getting on with it.

Mr. LANTAFF. A lot of people have the impression that NIKE is the answer to all our problems, and we can go home and go to sleep.

Mr. MCCORMACK. You say here, and I think it is pertinent, you say in the article:

> The improvements which we might thus achieve could spell the difference between America saved and America lost.

I think that is very pointed and potent.

Dr. HILL. I still believe it, too.

Mr. LANTAFF. You mentioned the expenditure of more money. Do you mean that the money should be spent in basic research, applied research, or development or production?

Dr. HILL. Primarily production.

Mr. LANTAFF. In production of models already developed?

Dr. HILL. Or almost, plus a little more in the field of other forms of defense. For instance, I pointed out that if we think of the populated parts of Canada and the United States as one entity, there is an awful lot of geography in the north and east and west, and certainly for a number of years these are the dangerous directions of attack, not south. We should use this geography to our advantage. We have not yet appropriated money for a far northern area warning line with its east and west extensions out to sea, nor have we planned for an air battle distant from our populated areas. If you shoot down a bomber carrying an atomic bomb over your city, you might still kill a lot of people.

The exploitation of this geography has not gone on as it should. Here is the real field for development and I think there is a chance some more will come along. We need more people in this field, but the real payoff will await production money to back it up.

Mr. RIEHLMAN. Is that project at present under consideration?

Dr. HILL. Yes, sir.

Mr. RIEHLMAN. It is?

Dr. HILL. Yes, sir.

Mr. RIEHLMAN. Your feeling is that there are not sufficient funds to promote the project rapidly enough under present circumstances?

Dr. HILL. The research and development itself, there is probably enough money at the moment. We might need more in the very near future. There is not yet enough enthusiasm although I think that is now in the bag, but as I say, the production of items and the rapid production of items is important.

I would like to make one other point here. If one deals in the civilian world of commerce, the economy that is important is the dollar, the monetary unit. If one deals in the economy of the military, I think the important unit is the element of time. The dollar, of course, comes in, but what is important is the element of time, and in order to make developments and productions and so on rapidly, it always takes more money. If you are in a commercial business, you call it wasted money, but if you are in the military business, I am sure you call it money well spent. You bought time with it, and time is important. Once we get into the position where we are behind in time, and the Russians can be ahead of us, then there is the danger.

So I want to buy time, and this means what an industrialist would call wasting money.

Mr. RIEHLMAN. Are there any other questions on that point?

Now, doctor, to get back to our questions, I guess we have gone to some degree probably into practically every one of them, but at different times in our discussion here.

I wonder if you have any other information which you would like to give the committee without going into detail into these different questions that we have given to you.

Mr. BALWAN. I think you have touched on the second, third, and fourth ones, and with respect to the fifth one, do you believe that this probably could be discussed better?

Dr. HILL. Yes, in the fifth question, to what extent should the Department of Defense contract with various types of institutions to carry on research and development, and to what extent should it be carried out in house?

Mr. RIEHLMAN. You touched on it somewhat, but we would appreciate your elaborating on it.

Dr. HILL. I think you always have to do a little in house work, if only to keep your contractors honest. You have to give them a little competition, and if you have to impress them with the fact that you have some technical competence yourself.

The division of funds, as I have viewed them in the three services, seem reasonable. I would not say that they are optimum, but they seem quite reasonable.

I think the military is not getting its fair shake out of its own in house research and development, and this has to be improved. I think if this were improved, a lot of their contracted work would be improved, too.

Mr. BALWAN. What do you mean by that?

Dr. HILL. I do not think they have enough competent people to monitor the contracted research, and I do not think they are managing it as well as they should.

Mr. BALWAN. You mean among the civilian directors or the military directors?

Dr. HILL. Both. I think quite often some of the research establishments, the military research establishment, are farther removed from the military problems than we are, for instance.

I know we are working in a way in which we can bring together at any time officers of the Research and Development Command, and officers of the Air Defense Command, and Army and Navy groups as well, and the thing we must always make sure of is that we are working on a military problem. Our job is not to advance knowledge, but to advance the military. I do not think there is as much of that in the service establishments themselves as there should be. Part of it is due to inflexibility. Part of it is due to the organization, the channels and the echelons through which they report. That makes it cumbersome. It could be improved upon.

Mr. RIEHLMAN. Are there any other questions of the doctor?

Mr. LANTAFF. I have one in line with the testimony of this morning?

Mr. RIEHLMAN. Yes, sir.

Mr. Lantaff. In the testimony this morning it was brought out that some aspects of the security program were having an adverse effect on the relationship of the Government and our scientists. Do you have any comments in that respect?

Dr. HILL. Yes, I do, and I will try to make them brief. We seem to have developed a fear in this country that we are overloaded with spies and the like. This fear has gotten very overriding in a lot of places. I know perfectly well that a Communist highly placed is an extremely dangerous person and we should try to prevent that.

There is a feeling among a great many scientists and a great many other people interested in national security that mutual suspicion is so great, a fear that if a man had a third cousin married to a Communist that he becomes a security risk and I am not exaggerating the situation there, that there is a great reluctance on the part of a lot of people to lay themselves open to the security investigation.

Also, I think the tightening of security regulations at many places has stopped the ready exchange of information. I mentioned before that unless one has an organization about the size of Lincoln, which is about 1,600 people, you cannot cope with the really urgent problem of air defense.

We also have to have close relationship with a great many industries and military people, too. If security regulations get to be such that we can never prove the need to know and to have the exchange of information except through very arduous and tenuous channels, we are wasting our time. I think the spirit of the country has gone a little too far in this direction. There is no question that the morale of some people has suffered greatly.

Also the inevitable tightening of security restrictions might go too far. It has not yet. I do not want to be an alarmist. It can go so far as to make the exchange of information which is necessary almost impossible or at least way too slow.

Mr. LANTAFF. What recommendations do you have in that field, if any?

Dr. HILL. My recommendations in that field of clearance for scientific personnel are that we use essentially the same system that we are using, that we do not penalize the officers in charge of granting

clearance for making honest errors of judgment. I think now we have called the attention of all to the consequences of making a mistake in this field, and that it is more natural for a man charged with granting security to say no, no, if there is the slightest doubt in his mind. I think this is a matter for education, and this is a feeling that has to be generated.

I am not familiar with the often quoted Executive order of President Eisenhower of the past year or so. I gather that that tightened things quite a bit. I cannot say I am a youngster and I am not familiar with it. I do feel that there has been an overemphasis placed on security risks.

Mr. LANTAFF. Do you know of any specific scientists or scientists who have left the Government because of those security measures of their own volition, or of other scientists who have refused to come into classified work because they did not want to run the risk of being classified as a security risk?

Dr. HILL. I suspect that several people have left or are considering leaving because of this. You never know when a person doesn't take a job. You are friendly with a person and you offer him a job. He is not going to say, "Well, I wouldn't work for you if it was the last place on earth."

He will say, "I am so busy and I am just so happy where I am now."

You never get that information.

Mr. LANTAFF. I think that is true, and anyone who requires employment is not going to say that he is declining your offer and will not say that he will not accept it because of the possibility of being turned down because of security reasons.

Dr. HILL. That is right. I have tried to search my own conscience about advising other people, and I have thought this way, that if a man is in his early thirties or early twenties, I would say to him, "Well, you read the papers. You know what the security risk is, and if you think you might be interpreted as one who would fall into that category, don't take this job."

Mr. RIEHLMAN. Are there any other questions in that field? Does counsel have any other questions?

Do you have any other information that you would care to give the committee, Doctor?

Dr. HILL. I would like to make one very general but short statement: I have talked a bit here in favor of Air Defense, and I think it is obvious if I did not believe in it and did not enthusiastically think it could be achieved, I would not be working on it.

I do feel it is only part of the military problem. Congressman McCormack was kind enough to quote from an article I wrote with Mr. Killian last August. We pointed out in it that there are four other military problems: First, control of the high seas; secondly, strategic bombardment; thirdly, defense of our allies, western particularly; and, fourth, the control of brush fires, the Koreans and Indochinas and so forth.

I think these things have to be stepped up a bit in time and perhaps in money.

I firmly believe that the best payoff right now would be a little more attention to Air Defense, but we should pay more attention to the others, too.

Mr. RIEHLMAN. Thank you very much, Dr. Hill, for being so gracious in coming down and giving us your knowledge and background and interest in this field of research and development for the interest of our country. On behalf of the committee, Doctor, we express our appreciation to you.

Dr. HILL. Thank you, and let me add quickly, that I consider it a great honor and I am very happy to have come.

Mr. RIEHLMAN. Thank you sir.

The committee will adjourn at this point. We will have a meeting tomorrow afternoon at 2 o'clock. The full committee meets tomorrow morning, so we cannot meet at that time, and tomorrow afternoon we will have Dr. Webster.

(Whereupon, at 4:03 p. m. the subcommittee took a recess until tomorrow, Wednesday, June 16, 1954, at 2 p. m.)

ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

WEDNESDAY, JUNE 16, 1954

HOUSE OF REPRESENTATIVES,
COMMITTEE ON GOVERNMENT OPERATIONS,
SUBCOMMITTEE ON MILITARY OPERATIONS,
Washington, D. C.

The subcommittee met at 2 p. m., in room G–53, Capitol Building, Hon. R. Walter Riehlman (chairman of subcommittee) presiding.

Present: Congressmen Riehlman, Lipscomb, and McCormack.

Also present: Michael P. Balwan, Staff Director.

Mr. RIEHLMAN. The subcommittee will come to order.

I would like to have the record show the members of the subcommittee that are present. We expect that Mr. Lantaff and Mr. Ikard will be here a little bit later.

This afternoon we are very fortunate in having with us Mr. William Webster who now is president of the New England Electric System, Boston, Mass.

Mr. WEBSTER. May I correct that? I am executive vice president of the New England Electric System.

Mr. RIEHLMAN. Let us get the title exactly right. I guess it is typed wrong here.

Mr. WEBSTER. I think it was; excuse me.

Mr. RIEHLMAN. I appreciate it, Mr. Webster. Of course, we have a large and long list of accomplishments and assignments that Mr. Webster has had in the past. He was appointed chairman of the Research and Development Board in the United States Department of Defense in 1950 and served in that capacity. The other accomplishments I will not put into the record but they are outstanding and of great importance.

Mr. Webster, our staff has had some correspondence with you, with respect to the interest this subcommittee has in the research and development program in the Defense Department. I am sure you are aware of our sincere interest in trying to do a constructive job through information gathered from outstanding people of background and experience such as yours to help guide us in our thinking and in our deliberations on this important matter.

With that brief introduction, we would be very appreciative of your giving us whatever information you can along the lines that we have suggested through letters and questions presented to you.

Mr. WEBSTER. Yes, Mr. Chairman, I suppose it might be best if I ran over a few of the questions that have been asked.

Mr. RIEHLMAN. That is right.

Mr. WEBSTER. And express some views on it, and then perhaps lead into some questions from you gentlemen.

NOTE.—Asterisks denote classified material deleted.

Mr. BALWAN. Do you think, Mr. Chairman, that it would be of any value to have Mr. Webster describe his past association with the Research and Development Board activities?

Mr. RIEHLMAN. I think it would be very helpful. We have it here but for the record's sake——

Mr. MCCORMACK. Can you not put that in the record?

Mr. RIEHLMAN. I can put this all in the record and then it would save him elaborating on it. Just briefly tell us what your experience was as Chairman of the Research and Development Board.

Mr. WEBSTER. Perhaps so that I will not be under any false colors here, it would be of interest to you gentlemen to get a little feel from my background so that you could see why I may have some of the views I have.

STATEMENT OF WILLIAM WEBSTER, EXECUTIVE VICE PRESIDENT, NEW ENGLAND ELECTRIC SYSTEM

For 12 years I was a professional naval officer. I went to the Naval Academy and was in the Pacific Fleet, was one of the group they sent for 3 more years' special training at MIT. I was a naval constructor. Then, when the Navy was cut back, I got out and went with the group of power companies I have been with ever since.

For 12 years I thought I would never have anything to do with weapons; but since 1941, I have put more than half my time in Government service on one or another sort of new weapons work. I was with Dr. Bush in the OSRD in what was called the transition office. Our job was to expedite, to try to get forward any device or weapon that the services said they wanted and could not get in quantity. That led us into a great variety of contacts with the services, of course. After the war I was a consultant to the original Joint Research and Development Board and then to the Atomic Energy Commission when it was first organized, which made me vulnerable in 1948 when they were looking for a chairman of the Military Liaison Committee. I put in something over a year and a half as deputy to Mr. Forrestal and chairman of the Military Liaison Committee that came between the services and the Atomic Energy Commission on all weapons matters, with manufacturers and scientists and some Congressmen as kibitzers occasionally. I escaped from that and got back to my company and I had not been there but 3 months when I was drafted again for the RDB so that after 16 or 17 months of that I went back to the job of trying to operate utilities in New England but have put approximately a quarter of my time since on various weapons contacts.

You can see that gives me a very spotty background to try to offer any expert opinion from. I am almost 3 years out of date on the real operations of the Research and Development Board so that comments I may make or criticisms I may make in some cases have probably been corrected. I would hate you gentlemen to feel that you have got any more value in view that that background justifies.

I do have several rather strong feelings, first, this is a tremendously big show and the general feeling that it can be run as a unit, that military research and development can be put either under one man or under one committee and run the way you try to run a company, I don't believe is possible.

We are now spending or were spending something in the order of $1½ billion for the Department of Defense alone in research. That is something like 30 times as big as the Bell Laboratory which is the biggest single research and development outfit in the country. It is bigger than the top 10 or 15 put together. It just is not possible to run a thing of that size without extensive decentralization. The example of General Motors, I think, is a case in point where their Chevrolet and Buick and Cadillac and different divisions are permitted to slug it out as long as they follow certain general policy.

The second point I would like to make just in general on this is that I don't believe there is any one answer to this problem. You have four different groups that are much concerned and have very different points of view. One is the user, the military service or man, so to speak, that is going to use the gun or the plane or whatever it is. From his attitude, he has no concern with cost; he does not concern himself with logistics or anything else. He wants the thing at the moment. He wants it just as exact and precise as possible.

The second point of view is that of the supplier. That is, the Quartermaster Department, or the appropriate logistics unit. That fellow, while he is, of course, interested that the weapon or the device be just as good as possible, is much more concerned that it is something that can be kept in shape, so that he can get his ammunition or his parts or his spares up readily.

Note that, even in the military, you have two different attitudes toward weapons. Then you have got your academic, your research point of view, who often are terrifically naive about military problems. I remember a story one of my naval officer friends said when they had gotten a fine new device that was 22 inches wide and the doors in the Navy were all 20 or 21. He said, "Why didn't they bother to see what would go through our doors?" You had to take this thing apart every time you moved it around shipboard.

The fourth is the manufacturer's point of view which is often very different indeed from that of the researcher. They are concerned with reliability. They are more concerned than anyone we have talked of yet with economy, and over a good many years my experience has been that if these four can really get together, and then sort of have an umpire, that you will come out with a better weapon or a better weapons system, a better device, than you will if any one of them is permitted to dominate it. If your general is permitted to bang the table and say, by golly, he is going to have a something, he may get it but it will cost many times too much and it will not be anywhere near as good a weapon as one that has been exposed to the views of the rest of these.

I gathered from these questions that your committee is primarily interested in the organization of the Department of Defense for Research and Development and particularly in getting some answers to the questions of how well the scientific fraternity is being utilized. The questions seem to run toward the morale of scientists, whether the present setup was even approximately as good as it could be, and seeking answers to, not to really getting an optimum setup but to improvements that might be made. Is that right?

Mr. RIEHLMAN. That is generally correct; yes, sir.

Mr. WEBSTER. I would like to run down. I have jotted a few points on the letters and the questions I had.

In the first letter it said, "Are there characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development?"

I think that statement is a little too strong—incompatible, the answer would be, "No." But there are certainly many disadvantages in it. A military organization is a very trying climate for the best work of scientists and we need to devise something that we can make use of, either firms or scientific organizations or individuals in a climate, if I may call it that, in which they can work better without completely getting away from a military organization. I think I will come back to that in answering another one of these questions.

The second one says, "Does the military organization of a research and development program tend to create conditions which retard the work of scientists?" The answer to that is definitely, "Yes."

And, "Does this make it difficult to obtain and retain the services of highly qualified civilian scientists and technical personnel?" The answer again is yes. Of course it makes it difficult unless you have a situation such as we did during the war when the obvious terrific need and the patriotism of scientific men made them come in and accept conditions and surroundings that they did not particularly like. You are going to find in general that your highest caliber scientists and researchers do not like being regimented and they are not going to want to work full term for the Government, particularly for the military. That does not mean that you are not going to be able in special situations to get very able men, and particularly a part-time situation, a tour of duty, so to speak, to get almost your highest grade men.

I think a part of the answer, though, is going to be in letting out subcontracts to organizations, to colleges, universities, and to business firms.

The fourth question, "Would it be feasible to organize military and research development programs in such a way that the technical activities capable of being performed by a civilian organization could be separated from those which are purely military such as support functions?" and the answer to that is in part, certainly that it is so.

It is calling for a good deal of restraint to ask a colonel or a general—I don't mean to pick on the Army—but a military officer that is in charge of a post such as Aberdeen or Wright Field, to sit back and watch his civilians handle themselves in a way that he may not think is best, but it can be done. This depends a great deal on the attitude of the commanding officer much more than on organizations.

I think with any of a number of sets of organizations, that could vary all over the lot from having a military man that would handle the administration of the show, but leave the technical work up to his civilians, and you can go all the way from that to where it would be almost impossible for a scientist or even a businessman, any civilian to operate. I have seen very able men who just felt so frustrated by what they regarded as interference on the part of their military commanders that they were not even able to do work that the type of organization would have permitted.

I have rambled here, but making that shorter, I think it is much more a question of personalities of the persons involved than it is the organizational setup. Of course, that reflects the view from the top.

Mr. McCORMACK. Would not the organizational setup in part produce an individual where personalities might develop?

Mr. WEBSTER. It would contribute to it, there is no question. Let me go off the record.

(Discussion off the record.)

Mr. WEBSTER. Let us say in general for the record that my view is that in most of these highly technical research establishments the military man can do best by handling the administrative and supply end of the situation much as the director of a hospital functions and leaves his technical staff free to work out the technical problems in their own work, exactly as the surgeon in the operating room is completely free of any restraint from the hospital administration.

Mr. RIEHLMAN. That is a good illustration.

Mr. WEBSTER. The next question says, "Where military support activities are necessary in connection with the research and development project, and such activities must be under a military commander, does it necessarily follow that the technical research and development functions must also be under direct military supervision?"

There I think the answer is probably no; but from exposure to a good many military setups, it is absolutely necessary that there not be two heads to the organization. It would not be well for the technical man to report to someone away from the post because this puts entirely too much strain on the two commanders to pull together.

I think it follows from this that the military man must be senior but must be under both general policy instructions and individua compulsion to keep his hands off the technical problems as much as is possible.

Again, off the record.

(Discussion off the record.)

Mr. WEBSTER. I am fairly certain that in a number of situations the technical director has been given the right or privilege to assign quarters to technical people and the Army commander has simply endorsed his selection, let us say. But my feeling is that the Army man—when I say Army I mean the services, Army, Navy, Air Force—should be in command but exercise the utmost restraint in how he handles his authority, how he uses his authority in the case of the civilian staff, of the technical staff. There are so many varieties of this that it is terribly hard to generalize; you go all the way from posts that are essentially military with a tiny little number of scientific or research, up to other posts that exist for nothing but either the research or the development of a highly technical device.

Mr. LIPSCOMB. You indicated that the military man should be the boss.

Mr. WEBSTER. First, I think there should be a boss, there must be a boss.

Mr. LIPSCOMB. Should be the boss, but the technical director, if there was one, should be the boss of the laboratory, should he not?

Mr. WEBSTER. Of the technical aspects of the laboratory.

Mr. LIPSCOMB. So the military man's bossing would just filter down to the technical director as it pertains to the direction of the laboratory.

Mr. WEBSTER. Ideally, that's right. But you have questions of what is to be worked on, what projects are to get how much money,

the funds coming out of the bureaus usually permit discretion. You get very involved questions of allocation of overheads and things of that sort. And I think you have got to leave the military man in charge of this sort of a thing unless you subcontract the work.

Now, it is entirely possible for a Government installation to enter into a contract with a university or for that matter with a manufacturing or business concern, to undertake certain work, and I think if that device were used a great deal more, that many of these problems as to who is the boss would be settled because then your resident manager, so to speak, for the contracting firm has rights of his own that are guaranteed by the contract or insured by the specifications of the contract, you do not have these problems that seem to come up when a civil service employee is the dircetor. An example of this, of course, is the Atomic Energy Commission operation of Los Alamos where the University of California has undertaken a contract to do a certain job on the development of atomic weapons, and that has worked very satisfactorily. The Atomic Energy Commission's personnel there administer the village, or the city now. They have all the problems of providing water supply, and transportation, and doing the things that the scientists not only would not do very well, but have no interest in, and at the same time they have no responsibility for the technical performance of the contract. The University of California has that. The University of California hires the scientists, makes its contracts with them; gives them their instructions, works out arrangements not too different from that on their various other campuses. This particular thing seems to have been done very well.

Similarly, at Sandia, the Western Electric Co. has undertaken a contract for the development and the manufacture of weapons. That certainly improved the situation there tremendously and seems to be working very satisfactorily. There is no one unique solution. This thing is just so big that I think it is a question of case tailoring each, not project, but each location, so to speak.

Of course, all of the things we have been talking about have been in the field. This has not applied to the Pentagon or to headquarters employment of scientists.

Mr. McCormack. Is not the important thing the selection by the Pentagon, or wherever they are, of officers, and assigning them to these positions of command?

Mr. Webster. Yes, sir.

Mr. McCormack. That comes not only—go ahead.

Mr. Webster. Not only that, which is tremendously important in the selection of officers, but the problem of developing some able, technically trained officers to take these jobs. The career schedule, of whatever you call it, for military officers works directly against the training of senior officers with strong technical backgrounds.

Mr. Balwan. Just rotation.

Mr. Webster. This rotation in duty, this requirement quite proper from a military point of view, all officers have a certain amount of combat, that all officers have certain foreign service, and things of that sort, make it very difficult indeed for men to have sufficient technical background to enable them to administer these big technical programs properly and to command the respect of the civilians that they supervise.

Mr. McCormack. I agree with you there has to be a boss. There has to be someone in command. We use the word, "boss," descriptively. And you said that the authority should reside in the military. You have broken it down. But I mean the No. 1 man.

Mr. Webster. This is in the field spots because in the Pentagon I am not sure that is the case.

Mr. McCormack. And it is vitally important that whoever is assigned by the military should be men of training whom the scientists and the technical attachés or—I don't like to call them employees—professional men, but who are in the service of the Government—civil service or otherwise—respect, and men who have retained the civilian outlook of life. From contacts, we know there are some men in military life who are rather authoritative. I say that in no critical sense. It is a life which produces that result unless one has a very keen differentiating mind. I would imagine so. So that there are many things, but from an organizational angle that could be developed to the maximum extent humanly possible.

Mr. Webster. I agree with that absolutely.

Mr. Riehlman. That is what you have in mind.

Mr. Webster. Exactly, because the ideal military man is trained to give commands and to expect obedience. That is almost diametrically opposite the characteristics that you look for in the head of a laboratory who is trained to use very talented individuals to the best advantage, to let them have their heads wherever possible, to put them to work on things they want to work on and probably do best, to supplement their weaknesses, and to use their strengths. And when you ask a man who has been screened through a military organization and selection and who must put much of his time on other strictly military work, when you ask him to measure up to the qualities that lead to a man being a division head or the head of the Bell Laboratories or a thing of that sort, you are just asking too much. It means that if possible we must develop a way within the services for technical specialists to be sure of their promotion without going through all the side issues that would be required under standard military training programs.

Now, the Navy has done this somewhat better than the other services. The Navy has through its Bureau of Ships in the old days and the Bureau of Ordnance and it is the habit—not habit but its practice of having an engineering-only designation and a certain amount of promotions guaranteed to their engineering-only officers; it has managed to train and attract and to keep in more men of high technical competence proportionately, I believe, than the other services. It is far from ideal. Again, off the record.

(Discussion off the record.)

Mr. Webster. Let us say that every effort should be made to insure the continuity of officers who are in charge of research and development programs. If it is not possible that an officer be left more than a 2- or 3-year tour of duty in such a spot, there should at least be long overlaps between the man and his successor in order that the impact of the change can be minimized.

Mr. Balwan. Could we not consider another policy in this case where, if it is desirable to have frequent rotations and if that is——

Mr. Webster. It isn't desirable, but if it is considered necessary——

Mr. BALWAN. If it is considered necessary to have frequent rotations, in those instances where the military officers are reassigned to the Research and Development Center, could they not be assigned there for the purposes of training, to acquire familiarity rather than for the purpose of commanding the installation? Since it appears that the rotation into a research and development situation is for the purpose of making him more familiar with research and development, then why would it not be desirable to send him there primarily for that purpose, to become familiar with it, rather than to upset the applecart as they do many times, and take command of the situation?

Mr. WEBSTER. I think it would be possible to send officers there for indoctrination and to become familiar with the situation, but that does not go to the heart of the matter which is, if we say there is to be a military commander or boss or what you will, great damage will be done the program if he is changed too frequently and if his successor is not permitted to have a sufficient overlap before having to assume charge of the program.

Mr. MCCORMACK. Have you any views on where rotation takes place whether that should be in some activity within the military that is directly related with the field of research and development in order to get the practical application, experience and——

Mr. WEBSTER. Obviously, every effort should be made to see that if there must be rotation that the man goes into an allied job that will supplement his scientific experience and fit him better to come back to a research and development job. The Navy Bureau of Ordnances lends itself to this more than some others since it permits an officer who has the technical duty in the Bureau to go to sea and work with ordnance apparatus during the tour of his sea duty.

Similarly, the Air Force could be in position to permit officers that have been in research and development work to be assigned to units that are using the product of their work. Unfortunately, this is not invariably done.

(Discussion off the record.)

Mr. RIEHLMAN. I think what Mr. Webster is trying to say to us is that this rotation program and this stepping in by the military and picking these keymen out of these very important positions is certainly very detrimental to this whole program and it sets it back considerably. It cannot help but do that.

Mr. WEBSTER. That's right, sir.

Mr. RIEHLMAN. And something should be done to institute a program that will permit these people to stay in this field of activity and, if they have to be rotated, be rotated into a position to observe what the end product is accomplishing. They could them come back into this other field and give their experience and knowledge of what the end product is doing in the development field; they could be promoted on that basis instead of on the basis of wide operational experience, which normally is necessary for a man in the military to get a promotion. At the present time he has to serve in many different areas in order to be promoted.

Mr. WEBSTER. That I agree with but it is very difficult.

Mr. RIEHLMAN. It is a difficult thing, but I think we have to take into consideration the welfare of our country and the effect that this type of rotating program is having on these major projects. I think this committee has reiterated this in the last 10 days many,

many times and my distinguished friend, Mr. McCormack, has said that research and development is probably the key to our survival in this country in case of an all-out war.

Mr. WEBSTER. I think you are right, sir; that staying ahead in this rapidly and acceleratedly changing situation depends much more on research and development than on any one other thing.

Mr. MCCORMACK. The military has to adjust itself to the atomic age.

Mr. WEBSTER. Yes, and to the rapid changes that have come with the atomic and electronic age. They have not the time to let things sink in on them that they used to have.

Mr. MCCORMACK. I think I would like to get your views; I think my colleagues would and it would be interesting to have it in the record as to how important you consider research and development in the world of today and as you project your mind into the future that you can in connection with having in mind the threat that confronts the world, nobody knows how long it will last, and having definitely in mind, of course, which all persons should have, the national interest of our country.

Mr. WEBSTER. It seems to me, sir, that the integration of research into our planning and selection of weapons and weapons systems is fundamentally all important. All applied research, of course, rests on a very broad base of basic research and during World War II we wrung dry some 40 years' learning, gains in fundamental research in a great burst of application and development. So that we are practically looking over the shoulders of the basic research people in the reach for new ideas and new things that could be applied.

Since then, despite a statement of many basic people that we are neglecting basic research, a great deal has been done to encourage that.

You may recall that the RDB made a rule that 6 percent of the research budget had to be put on fundamental research. Sure, there was a difference of opinion on definition, many things that the services considered basic or fundamental were not considered fundamental by the scientists, but it did result in a great deal of work being done that developed new learning and made it possible for the applied people, the people that were taking knowledge that other people had turned up, and turning it to the invention and development of weapons. It gave them some more to go on.

I would like to say what I think Bush and Killian and all our theoretical gentlemen are going to tell you, that just as a practical fellow, I think we have got to be very careful not to neglect the basic research because your military rarely want to spend money for this. They do not see the need of paying some theoretical physicist just to monkey around with cosmic rays or something they can't see. But it is those fellows that turn up the new nuggets of knowledge, so to speak, that are seized by the applied people.

Similarly, it is very important from my angle, from my viewpoint, for your intermediate people, the ones who are familiar with what the basic research ones are doing, to be exposed to the problems of the military. As I see it, the biggest single problem here is one of interlock. You have got to have the fellow who knows that which can be done see the need and you have also got to have the inventor, so to speak, familiar with the limitations of military machines. There is no use

making a device that takes a highly trained Ph. D. to operate it if it has to be used in quantity. You have got to work it out so that the farm boy from Kansas, if this thing is going to be used in quantity, he has got to be able to run it. And this is why, answering your question on research: surely the safety of the country and our survival is going to depend on our being ahead. But we are only going to be ahead if we have an interlocking and operating team, a team all the way from the complete, theoretical individual down through the trials of the final weapon or device in simulated combat.

Now, we haven't the time. We used to have time when, after the declaration of war we usually looked forward to having months and years, much time, to see just what our needs were, to pull in the people that could best supply the devices that were going to be needed, to let them work up the device and then have it manufactured.

The lead time on some of these things is terrific. The time from the conception of a new plane until the ability to have it in production in quantity is usually said to be 7 years. Whether that is 5 or 9 does not make any difference. Perhaps superhuman efforts could get it down to 4 or 5 but it means that we are going to fight the next war with things that are ready to use and we have got to keep devising and improving and putting on our shelf and putting into operation new and improved weapons all the time. That is expensive. It is wasteful and it puts a terrific premium on the men who decide how we are going to spend our money. There just is not enough money to do everything. It is not worth trying to improve a device or a weapon a small percent, even 10 or 20 percent. Unless you can take a real step forward, it will pay to use the thing that we have to let people get used to its use and used to the best way to take advantage of it, not to change our whole stock system. Take a jeep, for example. Everybody knew how to run the jeep. It would have been very foolish to improve that just a bit in the middle of your supply system; everything else would have gone. Similarly with rifles. We should go forward a pretty long step and this brings us into another very involved problem that is one that you gentlemen could do something about. That is the problem of the control of the direction of research and development and particularly prototype development.

There are about four stages to each new weapon. There is the idea stage when, oh, a dozen different ways to do it are tried out. That is usually very cheap, only a fraction, less than a percent of the whole expense comes in that stage.

Then you have what some of them call the bread-board and model stage when they are putting together in a fashion that may look very different from the finished product, and are trying out to see whether this idea will really work, proving its feasibility. Let us say you get that all right. It costs more than the idea stage but still it is only 1 or 2 percent of the final cost, 3 or 4 at the most.

Then you come to the problem of really making a prototype and trying it. That costs a deal more, a good deal more; may run 20 or 30 percent of the whole thing. You get one that is pretty much handmade that seems to be acceptable. Then you go into your actual effort to produce a model that is almost precisely what will be used in quantity and the final tests and all. There is where your money comes.

Now, at least three stages along the route you want to be sure to expose this idea or this device or whatever it is to the people who are going to use it. The first of those is after the idea has been worked out and they think it is worth doing further because you may find the users are going to say, that's fine, but if you just did it a little differently it would be three times as good. Or perhaps they will say, that's fine, but bear in mind that done this way it would not be any good to us for this reason.

So, while it is still in the inexpensive stage and not too much has gone on it, don't let your eventual user tell what to do but expose him to it; and the second time you want to expose him to it is after the hand model has been turned out. Give him a real look at it. You may find that the suggestions he will have will make it distinctly different from what the theoretical scientific or even the manufacturer has turned out and will make it of very much practical use.

Then, of course, the final time is before you really produce in quantity, your troops or your Air Force or your Navy should be permitted to take some of these devices and go play with them. They will come up with all sorts of ideas.

(Discussion off the record.)

Mr. WEBSTER. Then one of the most important things in the use, in the application of our research and development to weapons is the interlock between the men that have the idea and the manufacturing firms and the military users.

Mr. MCCORMACK. That is a matter of organization.

Mr. WEBSTER. That is entirely a matter of organization.

Mr. MCCORMACK. You cannot do that by legislation. You can give the proper authority, but that comes back to the organization itself, the type.

Mr. WEBSTER. Yes, sir.

I have drifted away from a whole line of questioning. I do not know how seriously or how much you gentlemen were interested in it. That was the attitude of the scientific fraternity.

I have been given about 10 questions here, all along the same general line.

Mr. RIEHLMAN. We are very much interested in that—if you want to, you may follow the questions or you may speak to the point.

Mr. WEBSTER. Since it is just as easy, since you have the list of questions, to follow the questions—the first "Civilian scientists and military R. and D. centers are reported to be generally dissatisfied with military domination and administration." My feeling is that while that is strong, it is absolutely inevitable. But any civilian scientists except in the time of the highest emergency, are not going to be happy under any military administration. That is one of the facts of life we have to live with.

Mr. RIEHLMAN. Now, if they are not happy, Mr. Webster, what effect is that going to have on their productive capacity and ability?

Mr. WEBSTER. While it will mean they won't do their best work, of course, and that we will handicap ourselves by losing or not attracting a great many, I don't think it is a certainty that pretty capable men cannot be attracted into a military type organization if it is set up right and run understandingly and intelligently.

Mr. MCCORMACK. You have given your answer by your last observation because all we can do is approximate as near as humanly

possible and with your last answer there is coming back to organization.

Mr. WEBSTER. Yes, sir.

Now, I do believe that because of the fact that civilians prefer not to work directly under the military that we should contract out a great deal more of this work than we are doing now and that more effort should be made to follow the Los Alamos type form of setup in many of our military posts devoted to research and development.

Mr. MCCORMACK. But you have got to have certain governmental activity.

Mr. WEBSTER. They have got to have a backlog of governmental activity.

Mr. MCCORMACK. I think that the testimony we have received has been pretty much along that line, so that you are not, you are pretty much in agreement with competent witnesses we have had both in the military and nonmilitary. I think among the competent military we have had there is not much disagreement in anything you have said in relation to——

Mr. WEBSTER. I think it is a question of degree, sir.

Mr. MCCORMACK. But there has got to be certain governmental activities and every effort should be made to develop the type of men, particularly in the military, that will, by ability, command the respect of scientists and the technical associates and through the possession of an understanding mind be able to give that leadership which reduces to a minimum irritation and friction.

Mr. WEBSTER. That is well put.

Mr. MCCORMACK. That is an art in itself and it can be done but the establishment of the proper kind of an organization can produce that net result, such as you have already described, other men staying in allied activity in the military, men of competence, men who have scientific knowledge, the understanding mind and the other factors.

Mr. WEBSTER. I think pressure should be put on the military or perhaps should be put on the units in the military from the top of the Department of Defense to contract out more chunks of work, let us say, than the military themselves are inclined to do. It is perfectly human to want to do something yourself—if the Naval Research Lab has undertaken a job and it believes its machine shop can turn out a device, time and again they or an organization like them is tempted to make something that if all the costs were known, they could have gone down to the hardware store and bought a better one.

In general, there should be pressure never to make what they can buy and never to undertake a job with military forces or for that matter with civil service forces that could be done by a university or a laboratory better and cheaper.

It is impossible to make a general rule. There is going to be a question of discretion, but I believe that in general the pressure had better be to say, contract it out, because it is very human for all of us whether we are military or not to let it get out of our own hands.

You can see what the implications of this are. The whole size of the Military Establishment would go down if this were done. All your allied costs, your administration, your overhead, your pension costs that go with it which do not get charged against the appro-

priation, so that the savings would probably be a good deal more than the superficial, immediately apparent saving.

May I go off the record here to illustrate by an example?

Mr. RIEHLMAN. Certainly, sir.

(Discussion off the record.)

Mr. RIEHLMAN. On the record.

Mr. MCCORMACK. How can we control the administration of research in the services?

Mr. WEBSTER. I believe this could best be done by attaching to the Secretary of Defense a civilian with the responsibility of overseeing the entire program but without the responsibility of administering or supervising all details of it.

The three services could well be left in complete charge of their separate research and development programs, subject to the limitations that their budgets must be submitted and approved as at present.

The administrative head—let us call him Assistant Secretary of Defense for Research—should have a small staff and be permitted to be kept completely informed of the entire research and development program. He should have the right to initiate studies or investigations along any research and development line, and should have at his disposal, subject to the approval of the Secretary of Defense, a sum of money that totals between 5 and 10 percent of the total research and development budget. This money could be used in either of two ways: He could either allocate it to one of the services for specific items of research that he felt needed doing; this could be either at the request of the service or on his own motion. The second way to use it, he could contract with outside organizations, either academic or industrial, for research and development that he felt could better be done in this fashion.

Now may I go off the record again.

(Discussion off the record.)

Mr. MCCORMACK. On the record.

What is your opinion, what would be your opinion about an Assistant Secretary for each one of the branches for research?

Mr. WEBSTER. This is something that I have no strong views on. there are advantages and disadvantages each way.

I believe on balance that it is probably best to have an Assistant Secretary specifically designated for research, but this in itself is not a panacea and probably the same result could be obtained if 1 of the 3 Assistant Secretaries had research as a primary part of his job and incidentally had other responsibilities.

Again off the record.

(Discussion off the record.)

Mr. RIEHLMAN. Back on the record now.

Mr. WEBSTER. I have rambled a good deal here, sir. Let's see if there is anything else I left out that I want to say.

There were a number of other questions that touched on the general question of "Should there be a new OSRD type organization?"

My feeling is that at the present time there is no place for such an organization for several reasons. One of these is the fact that it in itself would tend to become bureaucratic and to freeze into patterns of operation much along the line of the military research and development centers we have been considering.

The second is the fact that this would obviously be in competition with present ways of integrating research and development into the services and would make it more difficult to improve the stricter military operations.

Off the record.

(Discussion off the record.)

Mr. McCormack. For the record.

Mr. Webster. I believe we would make a great mistake to start a new OSRD at this time.

Mr. McCormack. In other words, the improvements have to be within the precise time, in your opinion?

Mr. Webster. I think that is the best way to undertake it, sir.

Now, we would accomplish much of the same by forcing more letting out, subletting of research to civilian hands.

Mr. McCormack. I think, Mr. Chairman, that the opinions in other testimony we have had have been pretty much along the same lines, so that I think that observation——

Mr. Webster. At least it is good government.

Mr. McCormack. Well, we have had some very fine outstanding men give us the benefit of their opinions.

Dr. Von Neumann—we were asking him on rotation and he made a rather original observation which made quite an impression on me.

We have evidence that some of the services' period of rotation is 1 to 3 years. His experience has been 4 years—in Ordnance, I think, wasn't it?

Mr. Riehlman. I think that is right.

Mr. McCormack. In the Army, apparently longer, and we told him it was about 2 years, and he said it takes the first year to learn and the second year you get your papers ready to get out, something to that effect.

Mr. Webster. That is about right.

Mr. McCormack. Which you could apply your commonsense to that and you could see.

Now, I know I have gotten a lot of benefit from listening to the opinions expressed by such competent and qualified witnesses as yourself and the others who have appeared. Ours is not an investigation; it is an inquiry as to what contributions we can make as a legislative subcommittee, legislatively or otherwise, in the nature of recommendations to improve a complex and delicate situation for the national interests of our country.

Mr. Webster. I think a plug for 4 years would be in order, sir, except perhaps for the first tour when younger officers are being exposed to this, partly to permit them to decide whether or not to go into engineering or development or research-type work, and partly to look them over to see whether they are considered particularly fitted for it, and there a 2 or 3-year term might be perfectly appropriate, but as officers return to positions of major responsibility 3 would seem appropriate as a minimum, and 4 better than 3.

Mr. McCormack. Even when that rotation went into a related field of activity?

Mr. Webster. I think so, sir. When a man is assigned to the command, for instance, of one of these major establishments, he simply cannot get the feel of either his personnel or the whole show of the

work that is being done until he has been there a year, and it doesn't make sense to pull him out too soon.

Mr. McCormack. Your civilians are career, usually?

Mr. Webster. Civilians are supposed to be career, although unfortunately, the best civilians are apt to take other higher paying jobs and move out, and the ones that stick are, in the main, not those of the highest competency.

Mr. McCormack. Well, the testimony we have received from those who have terminated their services is that the salary question was not the reason; it was the rotations.

Mr. Webster. It may not have been the primary reason, I agree with you, sir.

Mr. McCormack. They would have remained on if the——

Mr. Webster. And many very able men that could get much higher salaries have stayed with the Government scientific services.

Off the record.

(Discussion off the record.)

Mr. Riehlman. There is a roll call vote, apparently, Mr. Webster. Do you have any other questions, Mr. McCormack?

Mr. McCormack. No, I think that I—I could sit here for a week with him, but——

Mr. Webster. I am just repeating the same record now, I realize.

Mr. McCormack. I am enjoying the benefit of your views, but I have no further questions now.

Mr. Riehlman. Do you, Mr. Lipscomb?

Mr. Lipscomb. No, Mr. Chairman.

Mr. Riehlman. Well, I might ask this final question, and I don't know but what we hit on it in the first instance.

I would like your comments on whether or not you feel we are getting the best out of our research and development program.

Mr. Webster. I hesitate to comment on that in view of the fact that I am 3 years out of the closest contact.

Quite obviously, we are not getting the very best.

Under the circumstances, I believe that many able men and fine companies are doing a good and improving job. Unquestionably we could take advantage of the background that we have had in the last few years to improve the situation for the future.

Mr. Balwan. Have we done that?

Mr. Webster. I just plain don't know whether we have done it. I am out of the field, but it stands to reason that we can save money and do a better job by taking stock of the situation now and making the improvements that seem indicated.

It may be worth while to emphasize a point that is not always well understood. This is in connection with duplication of effort. All duplication is not necessarily bad or undesirable. As a matter of fact, in certain cases deliberate duplicate or parallel efforts may be highly desirable. It is easy to cite examples where the competitive effects of interservice, or even interbureau, efforts have resulted in improved performance and economy, and in the services having available better weapons or devices than otherwise would have been the case. Marine Corps versus Army; Naval Air competition with Air Force designs. Many examples come to mind.

What we must guard against is the duplication that is wasteful or unnecessary, and here it is that an impartial umpire is in the best

position to reach a proper decision and bring about an elimination, or at least reduction, of improperly duplicating efforts. This might be accomplished either through simply calling the situation to the attention of the appropriate service head or the Secretary of Defense, or through the power of the budget.

Along this line comes a second point that should be made. Perhaps the most wasteful single practice in Defense Department research and development is the failure to abandon or cut back projects after they have once gotten under way. This is partly a question of machinery and partly a question of practices and the very human unwillingness to look at something that once was justified and approved and say, "This is no longer worth going along with; let's drop it here and cut our expenditures." It may well be that the original decision was a perfectly good one, but that for any of many reasons the effort should be dropped. For all of that, such a decision usually involves hurt feeling some place, often seems to invite what could be awkward explanations, and time and again a project or effort is carried through to completion when it might better have been nipped in the early or middle stages of its development.

When we consider that the early effort is usually relatively inexpensive and that it is in the hardware or later stages of a project's course that the major expenditures are made, it is quite apparent that a severe pruning or thinning out here can result in major savings. This is a tough situation to improve but one that should be given high priorities for study and effort.

Mr. RIEHLMAN. I would like to say this to you, Mr. Webster. The record that has been made today, is, of course, in executive session.

Mr. WEBSTER. I have understood that, sir.

Mr. RIEHLMAN. Now, if you would like a copy of the transcript to correct it and add anything we will grant that privilege to you and see that any portion that you mark confidential will be deleted from whatever is made public by a ruling of the committee at a later date.

Mr. WEBSTER. I understood this was executive and I would like very much to have the privilege, because I realize I have said many things not precisely the way I would.

Mr. RIEHLMAN. Now, I would say this to you, if there are certain points and certain phases of this activity that you have touched on today that you would like to elaborate on which will be more helpful to the committee, we would be very happy to have you do that, sir, and reconsider your testimony.

Mr. WEBSTER. Thank you.

Mr. MCCORMACK. Off the record.

(Discussion off the record.)

Mr. RIEHLMAN. We will stand adjourned until 10 o'clock tomorrow, when Mr. Killian will be the first witness.

(Whereupon, at 4:33 p. m., the hearing was recessed to 10 a. m., Thursday, June 17, 1954.)

ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

THURSDAY, JUNE 17, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON MILITARY OPERATIONS OF THE
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met at 10:13 a. m., in room 1435, New House Office Building, Hon. R. Walter Riehlman (chairman of the subcommittee) presiding.

Mr. RIEHLMAN. The subcommittee will come to order.

This morning we are certainly honored by having a distinguished gentleman before the subcommittee, James R. Killian, Jr., who is president of Massachusetts Institute of Technology, Cambridge, Mass.

Mr. Killian, we know, and have been well informed, of your tremendous experience in this field of research and development, and of your sincere interest in it; and I think you are aware of our committee's activity and its interest in this great field. Therefore, again may I say, we are honored by having you give up so much of your very important time to come down here and give this committee information about a subject which we know is very important to the welfare of our great Nation in these very critical times.

I believe that the committee staff has discussed with you on a previous occasion some of the matters in which we are vitally interested, and I think you are prepared, probably, to talk to those points this morning.

If you have a prepared statement, we would be glad to have you read it into the record if you would like to, or use any portion of it as you would like to as you proceed, and put the whole substance of it in the record.

Now, I want to make this other statement at the beginning so you will understand. I think maybe the committee counsel has covered it, but if not, this is an executive session, as you know. You will have an opportunity to see the transcript and correct any portion of it you would like to. Any portion you feel should be marked as confidential will never be made public. If the subcommittee should decide at a future time to make the hearings public, we will certainly abide by whatever decision you make as to those portions.

Mr. MCCORMACK. And if in editing he wants to add and elaborate——

Mr. RIEHLMAN. We would be delighted to have him do that, yes.

With that introduction, would you proceed.

Dr. KILLIAN. Thank you very much, Mr. Chairman.

NOTE.—Asterisks denote classified material deleted.

STATEMENT OF JAMES R. KILLIAN, JR., PRESIDENT, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Dr. KILLIAN. I welcome this opportunity to come down and discuss this problem, and I am delighted that this committee is occupying itself with a study of it. I am sure that we can find better ways to manage our total research and development activity in this country.

I do have a statement, sir, which I will follow roughly and interpolate remarks as I go along, if I may.

In presenting my views, I wish to outline my relationships with the Department of Defense so that you may understand the experiences and limitations which reflect themselves in my testimony.

First, I am the head of an educational institution which has been called upon by the military services to undertake research and development in the field of military technology.

During the war MIT managed the great Radiation Laboratory, the center of our radar development, and at the present time we manage the Lincoln Laboratory for the three military services, this laboratory being devoted broadly to the problems of air defense against atomic attack.

MIT also currently has other classified activities in behalf of the military services and of the Atomic Energy Commission.

These kinds of activities are not normally appropriate responsibilities for an educational institution, but in a time of emergency, these institutions, in my judgment, particularly scientific institutions, have no choice but to undertake research and development when they have special resources of men and facilities relevant to the development of military technology.

Research and development projects of this military, classified type are not sought by my instituion, and have been undertaken by it at the request of the Government, and under conditions where it seemed clear that it possessed special facilities to do the job.

It should be added that there are many current examples which indicate that the management of military research and development by educational institutions results in effective and productive laboratories. This is true because educational institutions have, over the years, developed a special environment which is benign to research.

I might point out here that one of the fine examples of this is the Los Alamos Laboratory, which is managed under contract by the University of California for the Atomic Energy Commission.

In addition to my experience as an administrator in an institution undertaking this kind of work for the military services, I also at the present time am Chairman of the Scientific Advisory Panel of the Department of the Army. This panel has devoted itself largely to ad hoc studies of specific research and development problems of the Army, and at the present time it is in the process of developing an enlarged panel designed to bring more scientists into contact with military research problems of the Army.

My third relationship with research problems of the Government has come about through my membership on the Science Advisory Committee appointed by the President in the Office of Defense Mobilization. This committee has addressed itself to many aspects of our national scientific policy and has given some consideration to the problem of the operation of Government laboratories.

Finally, I should add that I have had no direct experience within the Department of Defense, beyond having served as a member of various committees, but I have had no direct experience within the Department of Defense in the operation of research programs, and that I am an administrator and not a practicing scientist. My comments, therefore, should be viewed against this background and within these limitations.

Before taking up some of the specific questions which have been raised by the committee, may I make some general observations about the philosophy of research and development and about the attitudes which are important to its successful conduct.

Sound organization can help, and poor organization hinder, the effective management and use of research and development in the Department of Defense, but even with a sound organization, progress will be retarded unless both the top civilian and military officers of the Department of Defense and of the three military services enunciate and follow policies which give research and development proper emphasis and urgency. I think this is fundamental.

In this respect the situation is quite analogous to what it would be in an industrial company that really understands and uses advanced research. Unless the president of the company, along with the board of directors, really favors research and understands its uses, no amount of organization or subcontracting in the company will make research effective in its application to a final use.

In this connection it must be understood that research is not testing, though testing may be a part of research, and that research cannot be regimented. It also, I think, must be made clear that research and development are two different things. Research is kind of a creative activity that generates new developments and ideas. Development is taking these ideas and trying to reduce them to practice. Neither of these is effective simply by the rule of spending money. The real effectiveness comes from brilliance and from the capacity of the men who are conducting the research and development. A hundred mediocre or even average scientists, or even a thousand, cannot be equivalent to one first-rate man working in an environment where he has freedom to exercise his imagination. And this, I think, points up clearly the difference between research in a military establishment and the operation of fighting a war where numbers of men do count very greatly.

Many of the technological advances that helped to win the last war, such as radar, the atomic bomb, the proximity fuse, were the result of the free-wheeling methods of outstanding academic scientists and engineers who had always been free of any inhibiting regimentation and organization. Every great research laboratory must strive to have men of this kind and to provide an environment analogous to that of the educational institution if it is to be really creative. The industrial companies that undertake pure research have found ways of doing this with great effectiveness.

There is a tendency at the present time to decry this kind of creative thinking about military technology and its applications and to urge that it be replaced by more conventional cut-and-dried procedures. I suggest that this is a mistake and that we are doing ourselves and our country a disservice when either the unconventional approach or the more practical or conventional method is sold short. We need both

methods and attitudes acting and reacting on each other to move ahead.

I also feel strongly that there should be a close coupling in our military organization between research and development and planning.

In the period of rapid technological change such as the one we are in, I do not see how the Chiefs of Staff or even the Joint Chiefs can effectively make policy decisions without a full understanding of the impact of new technology on tactics and strategy.

There has been occasional evidence that at times some of our top military leaders have been uninformed by their staffs about technological developments relevant to the decisions they were making. I suspect that this has been due to an attitude that tends to keep research and development at arm's length, and to the fact that there has not been adequate and direct scientific counseling in the formulation of top military plans and policy.

In making these comments I do not suggest that scientists and engineers have any special competence to consider military matters outside of their own fields. My suggestion arises, rather, out of a conviction that military planning has become so affected by rapid technological change that the military planners must have available to them prompt and adequate counseling on the impact of this development. There should be an adequate interplay between military experts and scientific experts.

To use an industrial analogy again, there should be for these reasons a vice president in charge of research and development who participates directly in the administrative decisions of the company. We are approaching this kind of organizational coupling in the National Defense Department. We should develop it further and we should also apply it in each of the three military services.

In other words, I favor the appointment in each of the military services of an Assistant Secretary for Research and Development, and I have noted in the recent bill that has been introduced to provide for additional Secretaries that there is no specification that one of these should be an Assistant Secretary for Research and Development.

The rate at which we make further advances in both offensive——

Mr. BALWAN. Mr. Killian, would you mind being interrupted, or would you rather wait until you are finished?

Dr. KILLIAN. No; I would be glad to be interrupted.

Mr. BALWAN. Mr. Chairman, if the members have questions—I have a question on that point.

Mr. RIEHLMAN. Go ahead.

Mr. BALWAN. I have made a note here that management must understand in industry and in the military the value of research and development, and it should be at the planning level by the managers, in which case each Chief of Staff of a department must be very close to it, as well as the Joint Chiefs of Staff.

This problem is a very serious one, which Dr. Vannevar Bush called to my attention when I had a conference with him quite a while ago.

I am not sure how familiar you are with the Rockefeller Committee report——

Dr. KILLIAN. Yes.

Mr. BALWAN. And the recommendations which were made in that which resulted in part in the creation of the Assistant Secretary of Defense for Research and Development.

Dr. KILLIAN. That is right.

Mr. BALWAN. As I understand it, there was another provision in that which advocated the setting up of a committee of senior military men, and I suppose some civilian scientists, who would be at the level of the Joint Chiefs of Staff, but not part of the Joint Chiefs of Staff, who would advise the Secretary of Defense and the President, as well as the National Security Council, of which both of the former are members.

Dr. KILLIAN. That has not been implemented.

Mr. BALWAN. That recommendation, however, did not require legislation, it was decided, and it was decided that it would be handled administratively.

Dr. KILLIAN. Right.

Mr. BALWAN. That has not been implemented, and I take it you feel there is a serious need for that?

Dr. KILLIAN. For a device of that kind I think there is a need. I think there are other ways of doing it other than through this kind of committee that was proposed. I think that was a good proposal, but I am convinced that an arrangement of this kind that can look at the total problem of military technology——

Mr. MCCORMACK. What other ways could you suggest, or have you in mind?

Dr. KILLIAN. Other ways? I think an opportunity on the part of the Assistant Secretary of Defense to make his information and knowledge readily available to the Joint Chiefs would be exceedingly important. We need a closer coupling there than we have developed in the past.

Mr. RIEHLMAN. How would that be carried out? Would you have an assistant secretary of each one of the services, Army, Navy and Air Force, assigned to that position?

Dr. KILLIAN. Well, we already have the Assistant Secretary of Defense. I think that the Assistant Secretary of Defense should have a chance to have a closer relationship than has yet been created, to my knowledge, with the Joint Chiefs, and then the Assistant Secretary of Defense in each of the services should have an opportunity to feed in the latest information and relevant material to the Chief of Staff of that particular service so that that Chief of Staff and his staff are always fully informed.

Mr. MCCORMACK. And then they also feed it to the Assistant Secretary of Defense?

Dr. KILLIAN. Very much so, yes.

Mr. MCCORMACK. And at that top level there would be the organization, team organization——

Dr. KILLIAN. That is right.

Mr. MCCORMACK. That would function to the maximum, dependent upon the type of men?

Dr. KILLIAN. Right.

Mr. BALWAN. Wouldn't the Weapons Evaluation Committee take on some of that work? Isn't that their function?

Dr. KILLIAN. Yes, but the Weapons Evaluation Committee has been largely concerned with analytical and mathematical studies of various weapons systems, and so on. I think it provides important conclusions and data to a person, but I think you need something beyond that. We need more than analysis. We need creative planning that makes full use of research.

Mr. BALWAN. Have you any idea how much the Joint Chiefs of Staff call in scientists? Do they call you in very much?

Dr. KILLIAN. No, sir. I think, so far as I know, there has been very little of that. In other words, I think there has been a tendency to feel that civilians and research people or staff people should not come in above a certain level. I don't know enough about how that is done, but the general impression is, that the Joint Chiefs have not found it desirable to call upon this kind of counsel.

I think some of the people like Webster and others who have served as Chairman of the Research and Development Board in the past would have very definite comments and information on this.

Mr. BALWAN. Dr. Bush will have some comments on this.

Mr. RIEHLMAN. Yes.

Dr. KILLIAN. Yes, he will; I am sure he will.

I am coming to another aspect of this.

The rate at which we make further advances in both offensive and defensive military technology depends thus in an important way upon the wisdom and the understanding in the Defense Establishment of the use of technological resources.

At the present time important new technological advances, in my judgment, are piling up and are only partially used because our normal planning and decision-making processes cannot respond and make use of them as fast as they become available.

We need more of what the engineer calls systems thinking about many of these problems that require looking at a whole range of activities that can be tied together to form a whole greater than the sum of its parts.

This whole problem of continental defense is an example of that, a systems problem that not only involves things we do within our country but things we do outside the country in order to see the problem in its totality and work out a plan that is integrated throughout the whole range of component activities.

Mr. RIEHLMAN. Did you have a question?

Mr. BALWAN. Mr. Killian covered that. I was just going to say that we had had the full impact of this thing that you mentioned brought to us in Dr. Hill's testimony, and that is that we have developments today with respect to our air defense which are not fully utilized——

Dr. KILLIAN. That is right.

Mr. BALWAN. And we are not taking care of our air defense because we just don't know how far ahead we are on this thing.

Dr. KILLIAN. That has been true in a number of different fields. I think what has happened in the laboratories, both in industry and elsewhere, has tended to be dormant for a period because people have not been able to get it into planning fast enough. This is a very important problem right now.

Mr. BALWAN. Mr. Killian, you are on the Army advisory panel. Is there any difficulty in getting that point across through the Army advisory panel for implementation?

Dr. KILLIAN. No, no difficulty whatsoever. There is the inevitable slowness in a large organization. I think I must say——

Mr. BALWAN. Is it something that cannot be overcome?

Dr. KILLIAN. Yes, I think it can be overcome, and, as I say, in the Army the panel has dealt with ad hoc studies of special problems so far.

For example, we are in the process of examining now the application of new scientific concepts that can help the foot soldier.

We have looked at certain special problems of the Chemical Warfare Service involving big laboratories; we have looked at the operations-analysis activity of the Army and made recommendations there. That is the way this particular group has worked.

Mr. LIPSCOMB. How often does the Army advisory panel meet?

Dr. KILLIAN. It has no regular meeting time. We meet in order to deal with special problems.

Take, for example, the subcommittee under the chairmanship of Dr. Hayworth that is studying the combat development program of the Army. It has made a tour of the country and examined all activities going on. The members are now preparing their report, which will be to the central committee which will look at it and pass it on to the Secretary and the Chief of Staff. I think it important to point out that this Army advisory committee reports to those two people.

Mr. LIPSCOMB. Are the recommendations that the advisory panel makes followed?

Dr. KILLIAN. They have been, yes, with certain difficulties inherent in carrying through things in a military organization. It takes time to get some of these things into effect.

Mr. MCCORMACK. What certain difficulties are inherent? Will you explain what—we can interpret it, but in connection with the subject under consideration.

Dr. KILLIAN. Well, here is a hypothetical example. We made one recommendation that the Army proceeded instantly to try to carry out, and this was that a certain research activity be contracted out, and they made heroic efforts to find an agency to undertake that research, and one after another, for some reason, found it impossible to do so, so that we were all stymied about how to get this problem resolved.

We also then made another recommendation, that a civilian man of very high caliber be brought in to work on this in joint arrangement with the military administration of this project to help expedite the program, and both our panel and the Secretary of the Army and the officers involved were again completely blocked because we couldn't pry a man loose to do that job.

Mr. BALWAN. Mr. Killian, if we went off the record could you tell us the specific project?

Dr. KILLIAN. Yes.

Mr. RIEHLMAN. Off the record.

(Discussion off the record.)

Mr. RIEHLMAN. On the record now.

Mr. BALWAN. Is there not a problem of organization in the case of the Army where, as I understand it, the Scientific Advisory Panel—I think I missed the person to whom it is responsible——

Dr. KILLIAN. The Secretary and the Chief of Staff.

Mr. BALWAN. The Secretary and the Chief of Staff?

Dr. KILLIAN. The Secretary and the Chief of Staff. Frank Pace set it up this way when it was originally created.

Mr. BALWAN. So that they do have a line of authority over the technical services to give orders and follow recommendations?

Dr. KILLIAN. Well, the scientific panel doesn't give orders, but it makes recommendations to these two top people in the Army, and

then it is up to them to implement them in any way they find it proper and expedient.

Mr. BALWAN. Organizationally, does the Scientific Advisory Panel work through the ADCS?

Dr. KILLIAN. We actually work through the Chief of Research and Development, General Uncles; General Nichols was occupying that post until he moved over to be Manager of the Atomic Energy Commission.

This is an interesting setup in the Army because the Chief of Research and Development as it was created in its last form involved this Chief reporting to the Secretary and to the Chief of Staff, and he is in a position, or has been in a position in the past, to break across all departmental boundaries in the Army, something that General Nichols did with great success. General Uncles has just come into this post so he is still finding his way, but potentially that setup in the Army seems to be very good, provided this officer who is Chief of Research and Development—and I have so testified before the Army's Committee on Reorganization recently—this man must have a position from which he can break across departmental lines, because of the technical service organization of the Army and all of the complexities involved there, in order to have any real impact on the overall research policy.

This brings me back to my point that I think in the final analysis it is going to be of fundamental importance in all three services to have a civilian in the Secretary's office whose primary responsibility is to deal with research.

Mr. BALWAN. They do not have that in the Army, but they do have in the Air Force, a special assistant almost at Secretary level?

Dr. KILLIAN. Yes, they do in the Air Force, but he does not have the force and authority of an Assistant Secretary.

Mr. BALWAN. But the Army doesn't even have a person of the stature organizationally of Mr. Gardner.

Dr. KILLIAN. No, it does not at the present time.

Mr. BALWAN. And that is a serious handicap, in your opinion?

Dr. KILLIAN. In my judgment, it is a serious handicap. This brings me to another matter I was going to bring up, that I think in general it is very unfortunate and a great handicap if procurement is mixed up with research, and there has been a tendency for the man who is responsible ultimately for procurement to be also responsible for research.

I think we have had many examples in all three services of where the philosophy of procurement, when it tended to dominate research, has proven a great handicap.

Mr. BALWAN. That is one reason why research and development in the Air Force broke away from AMC and became a separate command.

Dr. KILLIAN. That is one of the examples I have in mind; that is right.

Mr. LANTAFF. Can you think of a practical example of how some technical item was not properly developed or research was not properly completed before we went into war?

Dr. KILLIAN. Well, let me say what many people feel on the point of research.

There is quite a proper attitude and procedure in procurement that tries to account for every single piece of equipment down to the last nut and bolt and screwdriver. When you start doing that with research you may cripple it with redtape.

There are also contracting procedures in procurement that have been proven repeatedly not to be applicable to research and to hold it back when you try to make it applicable.

Mr. LANTAFF. The best policy to follow, then, would be to contract to private institutions or private laboratories for your research?

Dr. KILLIAN. That is, I think, one of the answers, and may I——

Mr. LANTAFF. And integrate your military into that?

Dr. KILLIAN. Yes, but in coming to this organizational problem, one of the reasons I think it important to have a civilian somewhere near the top who is responsible for research is to get a divorce between the procurement point of view and the research and development point of view. The two must work closely together, there is no question about that, but procurement's attitude should not dominate the research and development program.

I think you find this widespread through outside contractors authorized to work with the military services.

Mr. BALWAN. That probably would be more true when working on development than research itself——

Dr. KILLIAN. That is right.

Mr. BALWAN. Such as the guided missile program where even the research part of it requires so much hardware. There appears to be a problem of conserving costs because of the great amount of moneys involved, and the possibility that it could come under some organized procurement procedures, rather than in the program you just mentioned conducted by the Army, where it might not be as subject to these procurement policies.

Mr. RIEHLMAN. I wonder if you could proceed from where you left off there?

Dr. KILLIAN. Yes; I was talking at that time about my feeling that some kind of overall system study of these many technological advances should be made.

I believe that the study project is a very useful tool to elucidate and point up new opportunities for technological advance in military fields and that the military establishments should continue to make use of special ad hoc groups who come together for several months to examine in an uninhibited way unsolved technological problems.

Such studies have on mumerous occasions in the past brought about new concepts and new payoffs in military technology. It would be a great disservice to our defense and our future to adopt the attitude that these methods for doing creative and unorthodox thinking about our military problems should be avoided because they tend to interrupt the orderly process of administration.

I think it of particular importance that at an early date we should have a comprehensive overall evaluation by a competent group, including first-rate scientists and engineers, and other kinds of people, of what the real meaning and significance is of the enormously rapid advances that have been made recently in technology affecting defense.

I also feel it to be of vital importance that we have the kinds of groups and the kinds of laboratories where groups of creative thinkers

can have the opportunity to make wholly new inventions and technological breakthroughs even though such changes may modify existing concepts of tactics and strategy that have become national policy.

May I go off the record?

Mr. RIEHLMAN. Off the record.

(Discussion off the record.)

Mr. RIEHLMAN. On the record.

Dr. KILLIAN. The Scientific Advisory Panel has recommended to the Secretary of the Army that the Army consider the establishment of a Rand type of corporation.

Mr. BALWAN. An ORO, of that type?

Dr. KILLIAN. ORO performs many of the functions, but we think that an independent organization outside of the immediate context of the military organization would serve an additional function that would be very important.

Mr. LANTAFF. The Army does that——

Dr. KILLIAN. We so said.

Mr. LANTAFF. The Army does that already in some fields, do they not, Mr. Killian? I am thinking in terms of the contracts, for example, that the Army has let to certain universities in connection with the analysis of psychological warfare.

Dr. KILLIAN. Yes, although those are essentially research projects rather than analysis activity. There is something somewhat similar to this in what the Army has established in the combat development group that is set up with headquarters down at Duke University as far as research activity is concerned, but we still think in this advisory panel that the Army could effectively use, perhaps not on the same pattern precisely as the Rand Corp., but a similar exterior group who would work on a lot of planning that affects future weapons concepts.

Mr. RIEHLMAN. All right. Will you proceed?

Dr. KILLIAN. My next general observation is that research and development should never be subordinated by procurement. I have covered this, I think.

Now let me turn to some of the specific questions which the staff has asked.

Your first two questions I can answer as one.

I feel that the inherent characteristics of a military organization make it very difficult to operate a creative research organization, but that it can be done and has been done. It requires a breaking away from conventional military organization and usually the development of an effective combination of military and civilian management.

The difficulties of military organization are obvious. The rapid turnover in personnel and in general the absence of any officers who themselves are creative scientists make it very difficult to manage research directly.

I would stress, however, the conviction that military organization must find a way to adapt itself to the management of research and development, particularly in view of the fact that technology has come to play, and will continue to play, a major part in our military preparations.

I see no inherent reason why it would not be possible to develop within each of our military establishments a special philosophy of organization and a special preparation of personnel which would lead to the adequate management of research and development.

May I interpolate here, that I think the Navy in the development of its engineering duty only group of officers for the design and construction of ships has demonstrated this kind of thing can be achieved.

Mr. RIEHLMAN. Would you care to elaborate on what you think as to what type organization should be carried on within the Army and the Air Force in that respect?

Dr. KILLIAN. Well, if I may. Some of the things that would be required to accomplish this objective would be, first, the adequate education of a group of officer personnel in the field of science and engineering and the provision of adequate current opportunities and incentives to make science and engineering attractive as a field for first-rate officers.

The absence of such incentives and opportunities in the military services for men with these characteristics and education is now probably the most serious single deterrent to the adequate management of research.

There is now no widespread recognition in either the Army or the Air Force of men with special interest and competence in the field of research and development within the services, and I think this is the greatest single handicap we have to the research and development in the two services.

Mr. BALWAN. Could not some of that be overcome by the organization that has been adopted by Canada in which there is a kind of fourth service devoted entirely to research and development, headed by a civilian who participates with the Joint Chiefs of Staff and is a member thereof, in which the civilian organization for research and development runs as a civilian organization but that military officers are assigned and rotated into it for training purposes, and thereby develop technical competence?

Dr. KILLIAN. That is certainly one way, but I must confess I am a little dubious for our own American use of either the English plan, where they have their Minister of Supply, or the Canadian setup. I would prefer to see us develop within our own Army, Navy, and Air Force an adequate procedure for training and for providing incentives for people whose primary activities are technological and scientific.

Mr. MCCORMACK. Would you consider that to be a key proposition?

Dr. KILLIAN. Yes, sir; I think that is fundamental in this whole problem.

Mr. MCCORMACK. If that is solved in a practical way that would go a long way toward solving all our problems?

Dr. KILLIAN. Yes, sir.

Mr. MCCORMACK. So probably from an organizational angle in the military, as to scientists, it might be the key proposition?

Dr. KILLIAN. It is one of them, and I think one of the reasons why the Navy over a long period of time has had more success in its scientific activities (it was the first one of the services to get involved in technological activities, I should add) is that it has had these groups of officers who have had engineering background and training and are, therefore, competent to deal with complex matters of research and development.

Mr. BALWAN. In the absence of a large corps of technically competent officers, might there not be some interim organization that we could go to to carry out our research and development?

Dr. KILLIAN. I am doubtful about that. You are asking whether we ought to have at the present time a civilian office of scientific research and development, and my answer is no, because in the first place it is extremely difficult to recruit first-rate personnel that you would need to make such an organization successful under the present conditions of semiemergency which we are in.

Mr. BALWAN. I have no organization in mind, but I am just wondering whether or not it might be desirable to try to think of a plan by which we can carry out research and development in view of the urgency of the program today, and in view of the absence of technically qualified officers.

Dr. KILLIAN. I will make two comments upon that. If we could have the Assistant Secretaries which I have suggested, I think they could do much working with the Assistant Secretary of Defense to help bring about the proper management, and if we can develop the scientific panels in the way that the Air Force has done—it has done a superb job in its Science Advisory Board over the last decade—and that Science Advisory Board has worked very closely with the Chief of Staff of the Air Force and with the Research and Development Command and has generated a whole succession of new ideas that have been of profound importance in our air technology. The Air Force found out how to work with them, and it is a fine demonstration of collaboration.

Mr. MCCORMACK. We have been informed that the special assistant to the Secretary of Air for Research, special assistant for research, with other duties, that there is going to be a reclassification of his duties to where he has more opportunity to put emphasis upon research and development.

Dr. KILLIAN. That is fine.

Mr. MCCORMACK. Did Mr. Gardner give testimony to that effect?

Mr. BALWAN. I believe you are thinking of the Assistant Secretary of the Navy for Air, who will be given other research and development duties in addition to those that he has for running the Navy Air Corps.

Mr. MCCORMACK. Of course, I am for the proposition that you have suggested, because I have introduced bills to that effect, but I had an idea that Mr. Gardner——

Mr. BALWAN. Mr. Gardner is already the Special Assistant to the Secretary of the Air Force on the secretary level dealing entirely with research and development.

Dr. KILLIAN. That is right.

Mr. BALWAN. There is no such person in the Navy, but the Assistant Secretary of the Navy for Air will be given more responsibilities for research and development in addition to what he already has, of which we took a dim view because it just crowded him out.

Mr. MCCORMACK. I knew there was some change going through that would give it more emphasis. You have refreshed my memory.

Dr. KILLIAN. I think the Air Force, in having a man like this special assistant to the Secretary, which it had under the last Secretary as well as the present one, has demonstrated that a person in the top civilian group who is specializing in research and development can make great progress.

Mr. BALWAN. He is not necessarily a scientist, but a scientific administrator.

Dr. KILLIAN. That is right; he doesn't have to be a practicing scientist but one who knows how scientists work and how research is done. That is the important thing.

The second requirement that I would specify is that the laboratory project operated by the military establishment must have a clearly defined objective. And here let me point this up by quoting from an unpublished statement made by several members headed by Dr. Fisk of the Science Advisory Committee, who is vice president of the Bell Telephone Laboratories:

> An important, comprehensible job to do, and leadership—which will grow and mature with it—are primary and indispensable elements of a productive laboratory. Both points need further elaboration. Everyone knows what leadership is, although few will define or describe it well. The leadership here required is not solely in the laboratory, which itself is vital, but equally important in the management above the laboratory. Leadership in the management is more than picking a good laboratory director and paying him a decent salary. It is largely a matter of isolating the principal functional jobs to be done—the comprehensible and important ones—and giving the laboratory director the responsibility for carrying through the research and development necessary to solve the technical problems of those functional jobs.

I think this definition of the reason why a laboratory can be successful is very important, and, again, to use Los Alamos as an example, that is a good demonstration of where a laboratory has a very well defined, clearly defined objective to attain; that explains why it has been so successful in its activities, and I would point up, to bring in another part of Government here, that the National Advisory Committee on Aeronautics in the operation of its great laboratories points this up because they have been some of the most successful laboratories that the Government has operated.

Langley field and its other sister laboratories in Cleveland and on the west coast are impressive examples of successful Government laboratories. I would urge your committee to take a look at the research organization of the National Advisory Committee on Aeronautics as a pattern and demonstration of successful research carried on within all the limitations of civil service and all the other things that we sometimes hear are very limiting factors in conducting research.

Mr. BALWAN. Mr. Riehlman, would you object if I brought in an example of a particular operating center where this type of leadership is a problem that was called to our attention, namely, the Cambridge Research Center, which is closely associated with MIT's project there.

We had this illustration brought to us by the Air Force, where the technical director, Mr. John Marquetti, whom I think you know——

Dr. KILLIAN. Yes.

Mr. BALWAN. Was released from his duties. There might have been the possibility that there was a conflict of personalities between the general and Mr. Marquetti, in which case Mr. Marquetti should have been removed. In the particular instance, instead of doing that the general chose to abolish the job of technical director on the basis that no one man had enough competence in the field of atomic weapons, geophysics, and electronics. Therefore, the general was not getting proper advice from him and decided to abolish that and carry out the work under a steering committee.

I know that is a specific problem and we are dealing with something much broader than that. However, if you address yourself to that problem and give us your ideas, it would be helpful.

Mr. RIEHLMAN. The committee will appreciate it if you would.

Dr. KILLIAN. Well, I think there are factors in the Cambridge Research Center problem that are quite irrelevant to some of the things we have been discussing here.

I also might point out that I have deliberately avoided taking any point of view in regard to the controversy that took place there. I think it advisable that I continue not to take any particular side or point of view in regard to it.

I am sorry to back off there from this, but——

Mr. BALWAN. That is all right.

Mr. RIEHLMAN. That is all right.

Mr. BALWAN. It is very close to you, we understand.

Dr. KILLIAN. That is correct, and while it is wholly independent of the Lincoln Laboratory, the administration of the Cambridge Research Center is responsible for certain fiscal and housekeeping operations for research activities in the area, including Lincoln.

Mr. BALWAN. And the Lincoln contract is administered by the Cambridge Research Center?

Dr. KILLIAN. The housekeeping, not the scientific end. Scientific activities are largely handled directly by Baltimore, by the Air Force Research and Development Command, and by a steering committee representing all three services.

Mr. BALWAN. We did not know that.

Those are all the questions I had.

Dr. KILLIAN. Even with the limitations of civil service and other factors that affect Government operations, I still feel it advisable that strenuous efforts be made to devise ways whereby our military establishment can effectively conduct research.

That is why, in answering your earlier question, I feel we should not set up any temporary or ad hoc organizations. I think our problem is to find ways in which the military establishment can find ways to organize military research. If we duck that issue we are not going to solve the problem at all.

There are certain kinds of laboratories which must be managed by the military establishment itself. These include a few kinds of projects where the conditions and the secrecy are such that the activity clearly should be under the auspices of the Government. It includes test facilities such as towing basins and guided-missile test centers, and so on. It is imperative that certain branches of the military services have laboratories where they can get odd jobs of testing and development done without having to go through the mechanism of a contract with an external agency.

In other words, I think there should be certain kinds of laboratories always operated by the Government.

Having made the point that we must find ways of effectively operating military-managed research activities, I would also express my conviction that, in the main, the best procedure to be followed in conducting research, as distinguished from development, in the military services would be that of contracting projects out to industry and to nonprofit institutions. I think more industrial companies should be brought in than we have at the present time.

Mr. MCCORMACK. Now, Doctor, you have indicated, not only today, but I have read some of your addresses, concern about the emphasis at MIT on the contract work for the Government——

Dr. KILLIAN. That is right.

Mr. MCCORMACK. And its effect upon the primary——

Dr. KILLIAN. Primary educational responsibilities.

Mr. MCCORMACK. Now, you say contracting out to nonprofit——

Dr. KILLIAN. I say industry and nonprofit institutions, and I added that I think industry has not been brought in to the extent it should be.

Mr. MCCORMACK. Well, nonprofit, and the main part of that would be your educational institutions, and yours would be qualified as one, wouldn't it?

Dr. KILLIAN. Yes.

Mr. MCCORMACK. Now, doesn't your observation here conflict with your other observation? If the Government keeps utilizing MIT and other universities of that kind by letting out contracts, and there is the change in emphasis from education to research——

Dr. KILLIAN. To development; yes.

Mr. MCCORMACK. Would there be objections and resistance from the universities to assuming that work, with an increasing emphasis?

Dr. KILLIAN. I go back to my earlier statement, that I think in a time of emergency no kind of organization or institution can take the point of view that it should not do things of immediate and enormous importance to the Government. We have a duty.

Mr. MCCORMACK. And there is an emergency now?

Dr. KILLIAN. There is an emergency now.

Mr. MCCORMACK. You have answered my question.

Dr. KILLIAN. That is right.

Mr. MCCORMACK. I got both views; I wasn't interrogating you——

Dr. KILLIAN. I think in the long run it is not good for educational institutions to undertake work that is secret because it undertakes to contravene the free exchange of information, but I think there is no choice now but to do this kind of thing.

I think there are ways of doing it that help to minimize the bad effect, that is, segregation of laboratories, such as has been done in Los Alamos or Lincoln Laboratories, which are off campus and almost an independent operations, but managed by the university.

Have I answered your question?

Mr. MCCORMACK. Oh, yes. In other words, as a general proposition and under ordinary circumstances you would not favor your university taking over these contracts——

Dr. KILLIAN. No; the secret contracts having to do with military development.

Mr. MCCORMACK. But in an emergency such as we are undergoing now, the exception would be applicable?

Dr. KILLIAN. That is right; yes. Our universities must always be ready to serve the Government when special needs require their participation.

Now, in regard to the contracting out of research, I think we have a fine demonstration of its effectiveness again in what the Atomic Energy Commission has done, and the whole atomic development program has been handled under contract with industry and education. I don't believe there is a single operation, either manufacturing or research, that the Atomic Energy Commission conducts itself. Everything has been contracted out Clearly it can be done.

I think it worthwhile, however, to point out that in all of these laboratories, such as the Los Alamos, the NACA, Lincoln, and so on,

there is this element of focus and of a clearly defined objective, and also the elements of urgency that have helped to make these laboratories successful. One of the important considerations now is that we need to create in the minds of the people who work in military research and development more of a sense of urgency than I think has been created in the country at the present time. I think we are too relaxed in our national attitude toward the importance of some of these developments.

I think the only way we are going to meet this problem, since it comes down to a problem of recruiting first-rate personnel for these projects, is for the Government to indicate the urgency of these projects being carried through successfully. Those of us who have the responsibility for operating research projects feel a need for this at the present time, a need for our being backed by a clear mandate and a clear sense of urgency to do the job so we can go out and persuade people to leave their normal pursuits and come and work on these activities.

Coming now to the question as to whether it would be desirable at the present time to establish a civilian organization to administer military research and development programs, my answer is an unequivocal "No," for the reasons I gave earlier.

I think that under a greater emergency or under wartime operations an OSRD type of organization might well be indicated, but I do not believe it would work now.

I do not believe that a segregated monolithic research and development organization could do the job under present conditions because it wouldn't get the leadership that it would require.

Mr. BALWAN. And that is either within or without the Department of Defense?

Dr. KILLIAN. I would be inclined to recommend that it be without the Department of Defense, to follow the pattern that we followed in the last war.

I would advocate, instead, further contracting-out of research, particularly of the creative kinds of research where new problems and new concepts are being dealt with.

Under the immediate conditions we face, I would advocate creation of a greater sense of urgency on the part of the high levels of Government in order to make it possible for these civilian institutions to secure adequate personnel to man these activities handled under contract. I do not feel at the present time that our Government has made it adequately clear how urgent it is that these projects be adequately manned and carried through.

Mr. MCCORMACK. Will you state here, Doctor, for the record—I think it is important—what your opinion is as to the importance in the world of today and as you project your mind into the future in the field of research and development in connection with the security of our country?

Dr. KILLIAN. Well, I think it is of fundamental importance that we maintain our leadership in the effectiveness of our military weapons, both offensive and defensive; that maintaining our leadership is far more important than sitting on our secrets, and that sitting on our secrets will not be the way to maintain that leadership, but the way to do it is to create advances faster than our enemy. This seems to be the crux of our problem at the present time.

Mr. RIEHLMAN. Well, gentlemen, we have a quorum call confronting us at this time. We will recess for a half hour and resume in room P–18 in the Capitol.

(Whereupon, at 11:15 a recess was taken, after which the proceedings were resumed in room P–18 of the Capitol.)

Mr. RIEHLMAN. I think we will call the committee to order. Mr. Lipscomb will be here in just a minute, but I am sure he will not object if we proceed.

Mr. Killian, you were on a very important point that you wanted to make in your statement, and——

Mr. LANTAFF. Incidentally, Dr. Killian wants to leave on the 1:20 train.

Dr. KILLIAN. Yes; but this takes precedence over any 1:20 train.

Mr. RIEHLMAN. Proceed.

Dr. KILLIAN. As a footnote to the remark I made earlier in answer to your question, Congressman McCormack, I would like to suggest that the committee would find it very interesting to have placed before it the facts about the Russian compaign to increase the number of engineers and scientists in Russia at the present time.

I don't have the accurate statistical facts in mind, but I think it is true that they have already passed us in their annual production of professional engineers and the output of their educational institutions for educating engineers. They have been rapidly multiplying the educational institutions and increasing incentive in order to build up a cadre of men in this field, and have been doing the same thing in science as well as engineering.

There is no question that they are going all-out to build up the best group of professional people in this field that they possibly can.

I think this bears relation to our own problem in relation to our own military research.

Mr. RIEHLMAN. You mentioned this morning the fact that certain incentives had been held out to go into the field of science, and so forth. Do you have any information on that—or I think you suggested that we have someone before the committee who was well versed in that?

Dr. KILLIAN. Yes; I think Dr. Waterman, of the Science Foundation, has information on this that would be of value to the committee.

I do know from reports I have seen that the Russians are providing those kinds of living conditions and working conditions which make it very attractive for people to want to come into this field, and at one time I knew something about the patent incentives that the Russians have given to scientific workers, in which the inventors get a share of the savings produced by his inventions, or gets some other measure of gain that enables the inventor to profit. It is a straight capitalistic device.

Mr. BALWAN. I can contact some of these people and try to arrange for them.

Mr. RIEHLMAN. I think it would be well to have some information along that line, and as soon as we have finished with Dr. Killian and Mr. Bush we will probably decide what other witnesses we want, and we will give the committee the opportunity to decide.

Dr. KILLIAN. Finally, I suggest we must achieve a better understanding and rapport between the Government agencies involved and our civilian scientific and engineering activities involved in these fields.

In fact, I would put this latter need at the head of the list at the present time as being the most critical single problem we have in the whole field of research and development.

There has been, unhappily, a deterioration in recent months in the relationships between Government and science. The reasons for this deterioration are much more fundamental than the more simple problem of the relationship between members of the military services and scientists.

Great progress was made for a period after the war in the development of better and more effective relationships between military personnel and civilian research personnel. The problem has now come to be one of various trends, movements, and policies in this country having created a condition where members of the scientific community are clearly discouraged and apprehensive about the lack of understanding of scientific methods and in undue regard to what sometimes seems to be a preoccupation with security procedures and policies at the expense of scientific progress.

I believe that the whole problem of security procedures and policies at the present time may be one of the things that is most hazardous to our future research and development activity in this country in relation to military problems.

The feeling that the present security procedures can be handled and administered in a manner to damage creative activity and if they are, the feeling that the giving of an unbiased and objective judgment can be, under certain conditions, dangerous to the giver because this unbiased judgment does not accord with somebody's policy, all of these things add up to a great discouragement on the part of people in the field of science and engineering who are working in and for the Government, and I think that anyone examining into this problem at the present time cannot avoid looking at this problem.

I also feel very strongly that representatives of both science and Government have a responsibility to find constructive ways to minimize this widespread discouragement and to bring about a reconstruction of sound relationships between Government and the scientific community.

I think this responsibility rests upon both groups and that it is going to take the best judgment, the best good will that we can manage to summon in order to resolve some of the problems that we now face. This seems to me to be the crux of the problem at the present time.

In regard to question four——

Mr. LANTAFF. Before leaving that field, what specific recommendations do you have? You realize, of course, that we are always concerned with unimpeded scientific advance, but that the problem is certainly complicated because of the necessity for security.

You mentioned the great strides that the Russians had made——

Dr. KILLIAN. Right.

Mr. LANTAFF. I feel certain that they have security measures there——

Dr. KILLIAN. I am sure they do.

Mr. LANTAFF. Which are probably even more stringent than ours. No one would be labeled a security risk in Russia; they would be just taken out and shot.

Dr. KILLIAN. Right. There is no question in my mind that we must have a system that seeks to maintain tight secrecy in regard to weapons in this country.

Mr. LANTAFF. The idea is to find the system that is most consonant with scientific advances.

Dr. KILLIAN. Right.

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Dr. KILLIAN. Right. I must add that I am just as convinced as anyone that we must have a tight security system with respect to a whole range of weapons; I mean we must make it tight in every possible way, but I think we can go overboard in letting security stifle our creative activities.

(Discussion off the record.)

Mr. RIEHLMAN. On the record.

Dr. Killian, will you proceed from where you were, please?

Dr. KILLIAN. Yes.

I come now to another question that was raised in your letter, the feasibility of separating our technical activities capable of being performed by a civilian organization from the purely military activities. My comment here would be that much of this can be done, I am sure. In fact, I believe that all along the line there are many kinds of technical operations both in research and development and in maintenance that can be contracted out, more so than we are doing at the present time.

I think, for example, that the maintenance of a great deal of technical equipment in the field might well be contracted out to civilian organizations by the Military Establishment. In fact, we are getting into some very complicated technical equipment now, so much so that it requires people who have had experience in the management and operation of this equipment to really do the maintenance job.

Mr. BALWAN. In other words, we should not undertake to do what IBM would do in maintaining their complex equipment?

Dr. KILLIAN. That is a very good example. If we have a complex IBM computing machine setup, as we are certainly going to have in a lot of operations, it seems to me that the agencies who have had experience with that equipment can maintain it better than draftees or rotating personnel that have a limited experience.

Mr. RIEHLMAN. Well, we have another experience at Patrick Field where we have a contract. The Pan American Airlines and RCA and another corporation are there for the operation and maintenance of their equipment that is installed in the experimental and development stages of our guided missile project at Patrick Field.

Dr. KILLIAN. Right.

Mr. BALWAN. What we had in mind was the situation at Cambridge Research Center in which the Director has control not only of the research center but he also has Hanscomb Air Force Base. He is the military commander, and there is no alternative but to have a military commander.

Dr. KILLIAN. That is correct.

Mr. BALWAN. But where he has that problem there is a tendency, we felt, to have the military requirements sweep across both activities, the research activity and the activity at the field, and our question was: "Is it possible or desirable to separate the purely military func-

tion of operating an airbase in support of other programs from the research activity."

Dr. KILLIAN. My answer as a generality would be "Yes, it is desirable to do so, because I think the housekeeping can be done as a separate operation under military jurisdiction; that the operation of the laboratory itself might better be under specialized personnel, civilian or military, whose primary responsibility is research."

Mr. MCCORMACK. But command should be separated from research responsibility?

Dr. KILLIAN. You have got to have the command join somewhere, but I think that the director of the laboratory—speaking now of a hypothetical situation—must have very great responsibility for the management of the research program of that laboratory.

That comes back to the earlier point I made.

Mr. MCCORMACK. At least to a very considerable degree of autonomy?

Dr. KILLIAN. Right.

Mr. BALWAN. Lincoln Laboratory is an example of where to carry out a specific mission. They purposely separated its mission from the military and Hanscomb Air Force Base supports it without having to have command within Lincoln Laboratory.

Dr. KILLIAN. That is right. And this is working very well indeed.

Mr. BALWAN. There are no problems.

Dr. KILLIAN. There are problems that arise, but they are problems that can be solved readily so there is this segregation of authority and specialization of activity.

Well, does that——

Mr. BALWAN. That answers my question.

Mr. RIEHLMAN. All right.

Dr. KILLIAN. Well, these, in the main, are the comments I had Mr. Chairman.

I would add that from my own experience as an administrator of an institution undertaking work for the Government, we have had very highly satisfactory relations. I have been constantly impressed by the understanding of the military personnel responsible for the relationships between the services and our civilian projects.

There has been over the last few years a clear advance in the techniques of collaboration and in the obvious attempt and desire of military personnel to recognize the special characteristics of research and to find the contractual and procedural techniques which make it possible to meet these conditions.

The development of science advisory groups to the military services—I spoke of the Air Force Scientific Advisory Board—have also greatly helped the development of new military technology.

There is great advantage in bringing into the orbit of the military services as many creative minds as possible and making it possible for them to think about the problems of the services. In this way we maintain an important available resource of informed scientists and engineers who can be called upon when needed. I think this is a very important thing, to have a substantial number of competent people who know what the problems are, and when you have a special one come up in an emergency situation then you have people that can get at it fast.

Mr. BALWAN. Are you thinking in terms of a full-time group?

Dr. KILLIAN. No; I am thinking in terms of an advisory group now, and I think that is why I attach great importance to the advisory relationships that are being built up at the present time.

Mr. MCCORMACK. Off the record.

(Discussion off the record.)

Mr. RIEHLMAN. On the record.

Dr. KILLIAN. The overriding problem now, I repeat, is to reconstruct the unhappily deteriorated climate of sympathetic understanding which is necessary in the field of science and government, necessary to maintain the sound research in behalf of the Government, and this is going to require not only help from the Government but it is going to require poise and understanding on the part of the scientific and engineering people, also.

These are my formal remarks. I will be glad to answer further questions if I can.

Mr. RIEHLMAN. Thank you, sir.

Dr. KILLIAN. Thank you.

Mr. RIEHLMAN. We are certainly indebted to you for these remarks and the information you have given us up to this point.

Now, Mr. Lantaff, do you have other questions you would care to ask?

Mr. LANTAFF. No questions.

Mr. IKARD. I have one not directly on this point, but I think one of interest, and that is, Doctor, what is your appraisal of our position in the scientific race we are in? Are we maintaining our position of leadership, being caught up with, falling behind, or just what is the end result of all our efforts?

Dr. KILLIAN. This is a very difficult question to answer, but I will give you my general impression, and that is that in our total military posture I think that we are still in a position of superiority in terms of our research and development activity, but I think it would be a disastrous point of view for us to assume that we can maintain this without strenuous and constant efforts to keep ahead. I think it would be a great mistake to underestimate the competence of the Soviets and the steady advances they are going to make.

I think we have a very great problem of keeping a mobilized research and development program under way that goes all out to maintain our military superiority.

Mr. IKARD. Is it your feeling that Russia has made since World War II great advances in their scientific community and——

Dr. KILLIAN. All the evidence I know points in that direction, yes, and I think their achievement in the development of atomic weapons is a good example of that.

And I think there may be various fields in which other countries have gone further than we have. That is bound to happen from time to time, and continue to happen, but I see no reason for us to relax at the present time in making sure we keep ahead.

Mr. IKARD. That was the very point I was trying to establish, that we are not in a position to coast downhill.

Dr. KILLIAN. No, sir; we are not, and I do feel, also, that military technology is one of the most important ways in which we can keep ahead in our total military strength, as weapon development goes at the present time.

Mr. IKARD. Thank you, sir

Mr. RIEHLMAN. Mr. Lipscomb?

Mr. LIPSCOMB. Mr. Killian, a while back you were speaking of procurement, why there is a great deal of difficulty in the technical fields with the procurement policies of, perhaps, the armed services. Do you have any suggestions of how this procurement policy could work out or be separated so it would be more beneficial to the technical advance?

Dr. KILLIAN. Yes; at least I can point to some situations where changes have been made that have been successful.

I think the creation of a separate research and development command in the Air Force has gone a long way to remedy the problem in that service, and to provide a situation in which the procurement philosophy doesn't dominate the research activities of the Air Force.

In both the civilian and military administration of research, there should be a clear separation of the contracting of research and the planning of research from straight procurement activities, while recognizing that the two must be carried on in partnership, but with neither one dominating the other in their administration.

Mr. LIPSCOMB. Thank you, sir. That is all.

Mr. RIEHLMAN. Mr. McCormack?

Mr. MCCORMACK. Doctor, I inserted in the record a very excellent article written by you and Dr. Hill on continental defense. Would you care to express your views on that, your concerns which were clearly expressed, what the situation is, and what you think can be done to improve it?

Dr. KILLIAN. I think we are making steady progress in strengthening our continental defense at the present time, and that insofar as funds are concerned and general policies, that we are in a position to move ahead. I think we have a lot of hurdles we have to get over in terms of organization and in terms of implementation.

I think one of the major problems we face is in dealing with the problem of organization in which the total systems problem of our continental and civilian defense is brought into focus and under central management.

This seems to be, perhaps, the most important single aspect of this problem at the present time.

Mr. BALWAN. It is not, you imply, in that kind of focus now?

Dr. KILLIAN. I would think not, and this isn't said in criticism of any existing agency, because the Air Defense Command of the Air Force has a very definitely defined job to do and is doing it, but there are aspects of continental defense that it does not have jurisdiction over at all, and there is a question of the Navy's defense and civilian defense and how it is related to the total problem of continental defense.

Mr. RIEHLMAN. Off the record.

(Discussion off the record.)

Mr. RIEHLMAN. On the record.

Mr. Killian, may I say again that the committee is deeply indebted to you for giving of your time to come down here and give us this very important and timely information. I thank you on behalf of the committee.

Dr. KILLIAN. Thank you for your courteous and receptive listening.

May I ask, Mr. Chairman, when I see this testimony, if there are things that apparently should be made public that I could at least raise questions about them?

Mr. RIEHLMAN. Well, you just make a notation that they should not be made public and they will be eliminated from any public portion of this hearing that may be decided upon at a later date.

Dr. KILLIAN. I have assumed in my statement here that this could be made a public document.

Mr. RIEHLMAN. That is true on some portions of it, and we would be delighted to have you elaborate on any points that you have made before the committee this morning. And if you feel in the elaboration of that or as to any other portion that should be deleted from the record that may be made public in the future, we assure you that will never be made public. That is agreed by the committee, and has been in the past.

Mr. BALWAN. Off the record.

(Discussion off the record.)

Mr. MCCORMACK. This is for the record.

Dr. Killian, I join with the chairman in expressing pleasure in not only your being here and present, but in the valuable information you have given to us.

You have also had the opportunity of watching a committee of Congress operating in the highest degree possible because we have such an excellent chairman. That is the real success of committees, that is, the kind of man you have as chairman, and if you leave here with a favorable impression, as I hope you will——

Dr. KILLIAN. I certainly do.

Mr. MCCORMACK. It is the leadership, in the main, of the chairman, and I say this as constituting a wholesome expression in my mind of the admiration and respect I have for Congressman Riehlman.

Dr. KILLIAN. This has been a heartening and impressive procedure to me.

Mr. IKARD. I would like to join in Mr. McCormack's remarks as another Democratic member of the committee.

Mr. RIEHLMAN. Well, I will say this to you, Mr. Killian: No chairman is better than those serving with him on the committee; if he has good members working with him, he can work with them and accomplish things. I am fortunate in having such persons working with me, and they are all fine Members of Congress. It is always a pleasure to serve with the type of people that I have on the committee.

The committee will stand in recess until 2 o'clock this afternoon in room G–53 of the Capitol.

(Whereupon, at 12:35 p. m., the hearing was recessed to 2 p. m. the same day.)

ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

FRIDAY, JUNE 18, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON MILITARY OPERATIONS OF THE,
COMMITTEE ON GOVERNMENT OPERATIONS
Washington, D. C.

The subcommittee met at 10:20 a. m. in room G–53 of the Capitol, Hon. R. Walter Riehlman (chairman of the subcommittee) presiding.

Mr. LIPSCOMB (acting chairman). We will call the meeting to order.

Our chairman, Mr. Riehlman, has been delayed, but he will be here very soon now.

We are very privileged today to have as our witness Dr. Vannevar Bush, president of the Carnegie Institution of Washington.

STATEMENT OF VANNEVAR BUSH, PRESIDENT, CARNEGIE INSTITUTION OF WASHINGTON

Mr. LIPSCOMB. Dr. Bush, the committee has sent you certain questions which we understand that you have answers for, and also that you have a prepared statement.

Dr. BUSH. No, I have none, sir. If you prefer, I shall talk on the points of particular interest.

Mr. LIPSCOMB. Well, we would like to have you start by giving us just a little of your experiences during the war, and also what your present situation is, Doctor.

Dr. BUSH. At the present time I have no official Government post whatever. I have served informally as a consultant on a number of occasions, and I am a member of the National Science Foundation Advisory Committee on Government-University Relationships.

During the war I was the first Chairman of the National Defense Research Committee, and from 1941 to 1947 I served as Director of the Office of Scientific Research and Development. I was also Chairman from 1942 to 1946 of the Joint Committee on New Weapons and Equipment, which was a part of the Joint Chiefs of Staff organization.

After the war, from July 1946 to October 1948, I served first as Chairman of the Joint Research and Development Board of the War and Navy Departments and later as Chairman of the Research and Development Board of the Department of Defense.

Mr. LIPSCOMB. Dr. Bush, this subcommittee has been looking into the research and development program as it concerns the Department of Defense and the Army, Navy, and Air Corps, and I notice that our chairman is here, so I will let him continue.

NOTE.—Asterisks denote classified material deleted.

Mr. Chairman, Dr. Bush has just made an opening statement as to his background and experience during the war, and we were just now beginning the committee meeting.

Mr. RIEHLMAN. Would you continue for a few minutes, because I may have a long-distance call.

Mr. LIPSCOMB. So we are interested at the present time in having your views and opinions on what the situation is in regard to our research program in Government.

Mr. MCCORMACK. Particularly any recommendations as to how it might be strengthened and improved.

Dr. BUSH. Let me say first of all that the development of weapons is very closely interlinked with their use; and it is impossible to separate the discussion of their development completely from the way in which they are used in practice.

I think there are two serious weaknesses today that impede our program of research and development.

First, the security clearance system as now practiced is, in my opinion, doing great damage to the relations between science and Government, and particularly to the relations between scientists and weapons development.

Second, it seems to me that we have lost our effectiveness in getting new weapons tested, tried out, produced on an experimental basis, and finally introduced in use.

Now, let me take the second one first, if I may. About a year ago when I appeared before a committee that was examining into the organization of the Department of the Army, I was asked whether I felt there was anything wrong with the organizational situation in regard to new weapons.

I told the committee that we had just fought a war in Korea in which we had used no new weapons—no new improvements over World War II except the helicopter—and that was evidence of something wrong. Either the Army had spent a very large amount of money on development and produced nothing, or possibly it had thought that everything that had been produced was too important for use in a minor war where it would become known to the enemy, or there was something wrong in the organizational system that prevented the new things from really getting into use.

I am still of the same opinion, and I believe that the difficulty lies in our planning at the very top echelons. Unless our planning there is modern, forward-looking, alert, particularly on the matter of weapons, the whole system bogs down and things fail to move.

Now, I have felt for many years quite strongly that we are not organized at the present time for good vigorous planning at the top levels.

When unification was brought about the primary objective was to produce unitary war plans—to produce a unity in planning so we would have a single war plan with everything fitting into it. All other objectives of unification were more or less secondary to that one. Modern war so interrelates Army, Navy, and Air efforts that it is quite artificial to plan separately, and the Joint Chiefs organization was set up for the purpose of joint planning. But the Joint Chiefs are themselves the commanding officers of their services. They can give only part of their time to Joint Chiefs operations and planning. They are the primary group that is advisory to the Secretary

of Defense and the President on war planning. And I have felt that they do not handle their affairs so that we have objective and vigorous planning at the top level. I have said so many times—even in speeches.

Now, I am still discouraged on this point. A year ago the Rockefeller Board met and was charged with the job of recommending reorganization in the Department of Defense. It was an excellent board; it made a number of excellent recommendations that have been put into effect; but, in my opinion, its most important recommendation has not been put into effect.

It recommended that there be formed at the level of the Joint Chiefs of Staff a planning committee made up of senior officers detached from responsibility to their services, men on their last assignment, properly supported by junior personnel, to be given the full-time duty of examining into the way in which modern weapons fit into warfare. This planning committee was to report to the Secretary of Defense and the President, with the provision, and the very important provision, that while the Joint Chiefs themselves might comment on the committee's findings, they could not hold them up or withhold them.

Now, that was a very radical step in organization. It did not go so far as I might have wished, but I think it would have produced some really vigorous, disinterested, objective modern planning by a competent group.

That proposal was agreed to by the full Rockefeller committee; it was approved by the military advisers to the committee, Marshall, Nimitz, and Spaatz. It was approved by Mr. Wilson and Mr. Kyes before it went into the report. The President approved the entire report. Yet that particular proposal has never been put into operation, or at least it hadn't been a few weeks ago.

Mr. LIPSCOMB. Could I interrupt you at that point? There is a provision for it, isn't there?

Dr. BUSH. Well, it can be done simply by act of the Secretary of Defense

Mr. LIPSCOMB. That is right.

Dr. BUSH. It has never been put into effect, I am quite sure of that.

Now, until some such change is made, I think we are bound to be lame in our planning. Many of the things that are important are reviewed only by the Departments; the Joint Chiefs of Staff do not look critically into the plans of the individual services, and we have not had the full benefit of unification.

Now, there is an incidental aspect to all this; the relation of the scientists to the country and to the planning is not effective at the top levels. It has been quite effective elsewhere, and let me give you an example.

You have heard of the Viskin report, which was a very important analysis of the whole question of the use of tactical airpower, and in particular, the use of A-bombs tactically. It was instituted by the Air Force; there was a vigorous study made and a report presented.

Now, I think many parts of that report were not well founded, but there was a great deal of it that showed some very keen thinking and analysis; whether one agreed with it or not, it was an important document. That study was not done under the Joint Chiefs of Staff. It was done for the Air Force. And the report got to the Joint Chiefs of Staff only incidentally.

Now, we had a long discussion here in this country of North American air defense, and in my opinion we are a year or two behind where we should be in preparing for the defense of this country. There have been a number of reports on the subject, the Lincoln report, the Eastman report, and so on, extending over a period of years. There have been many studies, but they have not been instituted by the Joint Chiefs of Staff. They are coming about in other ways but are not heading into our planning. And I think this all shows that there is something wrong with our system of planning.

Now, let me turn to the other weakness for a moment, and that is the security system.

I don't need to bore you, certainly, with a detailed recital. I feel that the way in which our security system is working at the present time is driving a wedge between the military and the scientific people of the country, and is doing great harm.

During the war there was developed a partnership between military men and scientific men. It was not brought about automatically; it is not a thing that occurs readily. These men come from different backgrounds, and it is hard for each group to understand the other; but nevertheless, by the end of the war an excellent situation had developed in which there was mutual respect between the two groups and they operated together well. It must be remembered that one cannot plan modern war merely from the military standpoint or merely from the scientific standpoint. It takes both types of thinking to produce success. That partnership, which was a healthy one at the end of the war, is, in my opinion, now almost destroyed, and one of the primary reasons is the security system.

Now, I will not go into the Oppenheimer affair. I have written on that subject, and I think I should avoid entirely any question of the operations of the central committee. And I will not go into the Monmouth matter. But let me bring to your attention just 1 or 2 small incidents that will show the type of thing that is occurring all about us and that is so trying.

Last night at the Cosmos Club I ran into an old friend of mine, a scientist who, during the war, was in my London office. When I was at SHAPE a couple of years ago General Gruenther was planning to add a scientist to his staff, and I encouraged him to do so. I felt it would give him a set of contacts that would be very useful. When I was with him again at SHAPE in January he had made the move and decided to put it into effect. The man had been selected and he had accepted, and I had some conversations with him very early this year on his new assignment. I met him last night and asked him what he was doing back in this country. His security clearance hadn't come through yet.

Now here is a person who has a fine, distinguished record of service to his country in various ways, as you can imagine. He has been, since the war, head of the Weapons Systems Evaluation Group of the Department of Defense, which handles such top secret matters as radar, and he is not yet on his new post.

Well, that is merely a delay.

Let me give you another instance. Over in the Pentagon there are a great many of these security investigations going on. There is no statement made in regard to them officially, so that all I know is what I hear from casual conversations, but the fact that they are going on

is known throughout the scientific community, and they involve a number of men of some distinction who have given long service to Government. I could speak of a dozen of them, but let me give you just one instance.

When I was at SHAPE in January I worked with Field Marshal Montgomery in planning an important command post exercise which was to take place in April. At that exercise there were scientific teams, the subject being modern weapons.

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Now, these instances seem trivial, but they are not. The scientists, generally, that served well, loyally, and vigorously now find that they are being queried, and people are going about asking questions about them. The whole air of suspicion is just not such as to produce good collaboration, the kind of really wholehearted collaboration between military men and the scientific community that we very much need to have for the problems that are ahead of us.

For we are not at the end of the possible development of weapons. Not all the problems have, by any means, been solved. We hear a great deal about A-bombs and H-bombs; we do not hear as much about biological warfare, but I can assure you gentlemen that I am as deeply concerned about that as a possibility as I am about fission bombs and fusion bombs. I can also say to you that the morale of the scientists today as I meet them is low, so low that while they will not refuse to serve, they will serve without enthusiasm and without fruitful inspiration.

Now, these are the two weaknesses that I think are very serious in our situation today as far as new weapons are concerned.

Mr. RIEHLMAN. With your background and interest in this development program, you have touched on a very important subject, and that is this security matter, and I wonder if you have some recommendations that you could make to the committee as to how this matter could be corrected.

On the matter of organization, there is already a set of recommendations; and although I think the recommendation of the Rockefeller committee for the setting up of a special planning committee that I have mentioned would not solve our whole problem, it would be a step in the right direction. That recommendation would change the situation quite decidedly at the Joint Chiefs level. It will require more than just one change in organization to effect a change of atmosphere at that level; it will require a change in point of view. But certainly I feel that the setting up of this special planning committee would help enormously to bring some things into effect that are now dragging—and there are some interesting things. We should have at the Joint Chiefs level 3 officers who could join with them such scientific men as they might wish for their consultations—3 officers of

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great skill who understand thoroughly the trends of the development of weapons and scientific affairs. They should no longer have any ties with the services, hold no posts in them and not go back to them. They should be selected because they have been able to rise above narrow service interests in their thinking, and have the confidence of the Secretary of Defense and the President.

I know you don't want me to go into them, but there have been developed some very interesting and important advances in weapons which I think, vigorously pursued, could help us greatly.

Would you like to have me give you just a view of how I look at the future in this respect?

Mr. RIEHLMAN. Yes, sir.

Dr. BUSH. Well, let me do it this way.

When I was at SHAPE—General Gruenther calls me over there once in a while for staff conferences, and incidentally, I find there a very vigorous, intelligent group of officers who discuss matters without pulling any punches whatever—we were discussing the way in which the armies would need to be handled in the field. I said that we needed to consider three possibilities at least: First, that a war might break out in which the air fleets would start dropping A-bombs and the war would be over before the armies came into contact, before there could be any decision on the ground; second, that a war might break out in which the armies would come into conflict and the fleets would not move, and there would be no strategic bombardment; and third, that we might have a war in which there would be ground action with A-bombs used tactically but not strategically—a possibility that I thought was fairly remote.

I think these three possibilities have to be taken into account, and I believe there is a strong probability as things stand today that we may be facing a long period of stalemate when both we and the enemy will have great stocks of A-bombs and H-bombs, but neither side will precipitate the all-out war in which they will be used—a period in which there will be continual minor wars fought with other weapons.

There is one thing that worries me. If we are to have such a period of stalemate—and I think that is about as good an outlook as we can have today—we must be very sure that a surprise attack by A-bombs on this country would not prevent our retaliation. I am not myself sufficiently reassured on this point to be comfortable, for it would be exceedingly tempting to the enemy to make a surprise strike if he could put us out of business at one blow.

We must be very sure that a surprise attack will find us ready to retaliate not only by having fleets and A-bombs but by being protected in our installations so that they cannot be destroyed before we are able to retaliate. If such a situation obtains, I think we may go into a long period of stalemate as far as A-bombs are concerned; but we must expect operations such as those in Korea and Indochina or at least the threat of them. The development of other weapons therefore becomes very important, and earnest attention should be paid to those that would be particularly useful in the type of fighting that may result.

I believe there are such weapons under development that would be very useful. I do not feel that our planning is now sufficiently flexible and vigorous to make great use of them and bring them along in time to have their use mastered by proper training in field maneu-

vers; and I don't believe this will be accomplished until we have more effective planning at the top.

Don't let my words make you think I am generally critical of our military men, because I am not. They have shown many times that we have as fine a group of military men as any country has had in history, and I have great respect for the judgment of some, and since the war they have become close friends of mine. I think the Joint Chiefs are placed in an impossible position because of their organization. They need to be supplemented in order to function vigorously.

Mr. LIPSCOMB. Mr. McCormack, do you have any questions?

Mr. MCCORMACK. Doctor, I listened with a great deal of interest to every word you said. I am not putting anything you said in a secondary position, particularly your latter observations as to your views as to the present situation. I assume that your views on the fact that one of the three possibilities that the H-bomb or even more destructive bombs might not be used, are based on the fear on the part of the enemy of the effect upon their people and their country and the retaliatory moves made by us; is that correct?

Dr. BUSH. Yes.

Mr. MCCORMACK. Of course I can see that, but in my mind it goes beyond that. I go into the origin of their thinking; and of course we know the origin of their thinking is hate in the most intense form, and they are really possessed of what I have described on many occasions as a world-killer mind, the Communists, and it is pretty difficult to apply the rule of probabilities or reasonable probabilities to a killer mind; at least I have found it so, and will you agree with that?

Dr. BUSH. I think there is just one thing you can be sure of, and that is they have a strong sense of self-preservation.

Mr. MCCORMACK. Well, that comes back to the first law of nature.

Dr. BUSH. Yes.

Mr. MCCORMACK. But it would be more easy for you and me to apply the rule of probabilities to some other country and its leaders and their people whose origin is essentially the same as ours rather than to those whose origin is directly the opposite, such as the Communist origin is. In other words, to try to bring to your mind what I would like to get your opinion on, it is best not to proceed on the theory that there might be a stalemate, but it is best to proceed upon the theory to hope for the best but to expect the worst?

Dr. BUSH. Quite right.

Mr. MCCORMACK. And be prepared for the worst?

Dr. BUSH. Quite right. I think we always have to take into account the three possibilities, and act not on the basis of one but on the basis of all three.

Now, we go back to the point of view which you were bringing out, I feel that for a long period after the war the A-bomb in our hands was the deterrent which prevented the Russians from sweeping across Europe, and that was not so much because they felt that they might be defeated in war as it was this:

The men in the Politburo knew that if they launched any such attack and we put A-bombs on Moscow promptly, at the end of the affair somebody else would be ruling Russia and not their particular group.

They thought, also, that if they got their armies in the field started, although those armies might keep going, they would lose their control.

They might conquer Europe, but it would not be the present ruling group of Russia that would exert the power afterward.

So the deterrent power was not entirely the A-bomb but was also a political consideration.

Now, I am quite sure of this line of thinking: the Russians would not force an all-out world war that would mean the indiscriminate and thorough use of A-bombs and H-bombs and gas and biological warfare if they thought it would be a mutually destructive affair. If they thought it could be done in such a way that they should quickly prevail and we be destroyed, that would be one thing. Such an outcome would be very tempting to them indeed; but I do not believe they would launch a war they felt was going to leave both countries completely devastated, leave them so devastated that the center of power would move elsewhere.

Mr. McCormack. The center of what?

Dr. Bush. The center of power would move elsewhere. There would no longer be a Russia and a United States; the world would have a different type of civilization from the one we now know. I don't think, however, that the Russians would commit suicide in such a manner, particularly because they seem to be quite successful as things now go. They are getting what they want pretty well. So I don't believe they will force an all-out war, and I feel strongly that we must be very careful not to force it. Our use of the A-bomb, for example, in a minor affair such as in Indochina would be foolhardy in the extreme. But, of course, as you say, it is better to proceed on the theory of hoping for the best but expecting the worst. We must be ready for the war, if it comes as a total war; we must have a strong defense in this country, as strong as we can have; we must have a powerful retaliatory force—a force, above all, so prepared that it cannot be destroyed by a surprise attack; and we must be ready to evacuate our cities and take all other needed measures to insure our survival. We must make our plans, but we may at the same time hope that they will not be called into action.

Mr. McCormack. Well, if you were charged with the responsibility—let's assume that you have the views that you do, that you don't think they will do that because of the terrible destructiveness that would follow to themselves—would you, if you were charged with the responsibility, would you follow that if you were in their position?

Dr. Bush. If I were in their position?

Mr. McCormack. Yes.

Dr. Bush. Well, it is a little hard for me to put myself in the position of the Soviet rulers.

Mr. McCormack. No; the responsibility in America.

Dr. Bush. Oh, that is different.

Mr. McCormack. Would you follow your hopes and ideas and views and say "Well, we will take a chance and hold off doing this and that"?

Dr. Bush. No; not at all. I would very vigorously pursue a number of things. In particular, I would put far more emphasis on getting an adequate air defense for the North American Continent than has been put on it; for I feel, as a good many do, that adequate air defense has been a secondary consideration, that it has not been pursued vigorously, and that we do not have today the air defense which we

could have in the North American Continent if we had been more vigorous. We know that results can nowhere be 100 percent perfect; nobody expects them to be. But air defense is to be reckoned very seriously as a deterrent. The Russians are much less likely to strike if they feel that we have a powerful defense, which they think might be highly effective, even though its effectiveness cannot be known until it is tried out. They will not strike unless they feel sure that they can overcome our defense, and so that I think it is exceedingly important that we should have a good North American continental defense, and I believe the instrumentalities for producing it are available. We are pursuing it; we are going ahead on a program, but not with the sense of urgency that I think the occasion demands.

Mr. McCormack. Well, I will ask some questions later, but perhaps someone else has some now.

Mr. Riehlman. All right.

Mr. Lipscomb. Mr. Lantaff?

Mr. Lantaff. By a sense of urgency, Dr. Bush, what do you mean—the expenditure of more funds, the recruitment of more of our scientific brains, or just how would you implement this air defense program?

Dr. Bush. Well, if I were the President of the United States—God forbid—I would know how I would go about it. That doesn't mean that my way is the best way, but if I were the President of the United States I should see that the air defense in the North American Continent became the responsibility of one general, one of the best officers in the services, who would have full authority over the various aspects of the matter all the way from development to installation, training, and operation of the system; I should make it clear that he had my full backing; and I should say to him, "You get busy and get us into a good defensive position as fast as you possibly can." I think if we centralized authority on this problem we should go much faster.

The second thing I should do would be to say, "We are behind where we should be in our air defense. I want the collaboration of every branch of the services and I want the collaboration of all the scientific men of this country. We must achieve adequate air defense as rapidly as possible."

Now, I think some things could happen under such circumstances. We have today some excellent devices for air defense. Early warning radar has been developed into a far more effective thing than it was 5 years ago. Some of the ground-air missiles, nikes, are powerful devices. We have some excellent instrumentalities to put into the system.

But I also know this: If the program was going ahead vigorously and with full support and full emphasis, new things would also appear because the experience of the last war showed that time after time, when there was a vigorous program underway and people were thinking about it and working on it, new things, new ideas, came out of the thinking, so that although we have good instrumentalities today, I am sure we could have better ones if we tackled the problem with full vigor and interest.

Mr. Lantaff. Well, we do have now, do we not, a commanding general of the Air Defense Command?

Dr. Bush. Oh, yes; our air defense of the United States is in the hands of the Air Force, second echelon, but——

Mr. LANTAFF. You mean in your opinion it almost should be brought to the level of the Joint Chiefs?

Dr. BUSH. Quite right, but not under the command of the Joint Chiefs.

Mr. LANTAFF. Not under the Joint Chiefs?

Dr. BUSH. No, sir. The Joint Chiefs of Staff of the United States is a staff, not a line of command.

Mr. LANTAFF. Where would the line of command be to this——

Dr. BUSH. I would make it a task force, like a theater command. I would ask for the recommendations of the Joint Chiefs in regard to its formation and in regard to the officer at the head of it, and set it up as an office of theater command similar to the theater command which heads in Europe.

Mr. BALWAN. Or Hull in Korea?

Dr. BUSH. Yes, These things are unsettled, and a great deal depends on what the climate of opinion is. For many years the subject of defense has been in the background. It is the natural approach of the American people to think of offense. When the first H-bomb explosion took place what was the reaction of the American people? Generally the reaction was, "This is excellent. We now have a very powerful weapon to hit the enemy with." The reaction was not at all "But the enemy will soon have an H-bomb, also, and now we are entering a very grim world."

Now, I should regret any situation where we become obsessed with defense, where we had a Maginot-Line complex. It is a question of properly balanced effort. No sound attack can be launched, as you know, except from a secure base. A certain amount of defensive effort is always exerted by a commander in the field before he plans his offenses. It is not that we should go into a frame of mind where we try to isolate ourselves, where we are surrounded by a war and can't be reached. We can do no such thing. But we need to restore the balance so that we have a defense that is as good as it can be made with reasonable effort and expenditure, and on this score I think we are far behind in the accomplishment of the great things that could be done.

Mr. BALWAN. I think your concept is that an adequate defense is a necessary part of being able to assume the offensive by retaliation——

Dr. BUSH. Right.

Mr. BALWAN. And without the defense we may never be able to retaliate. Do you think that the attitude of the scientists today is such that they are convinced of the great need for developments in the field of air defense?

Dr. BUSH. Of course they are not unanimous on it. They never are on anything. But I think that 9 out of 10 scientific men who are in a position to know something about the situation, that is, who have been working in a place where they know about what the present situation is, feel that we have been altogether too slow and that we need vigorous action to catch up on our defense.

Mr. BALWAN. I think that is the general impression we have obtained in these hearings.

Dr. BUSH. Yes.

Mr. BALWAN. Now, if we should go ahead with this program that you have mentioned with reference to air defense, do you think that even if the President, with a strong statement and exercising positive

leadership to try and bring together all of the forces so as to develop our defenses, that it would be successful unless something is done about the security program. Do you think that that would so impede it that a lot of our monet would be wasted in trying to build this up?

Dr. BUSH. The two go together, and we also need to clear up the security matter and get back on firm ground. It is merely a question of how well the scientist group will work. There will be no refusal on the part of scientific men to respond when called on. You won't find any strikes, or any such thing. But scientists today are discouraged and downhearted and feel that they are being pushed out, and they are.

Mr. BALWAN. It is a question of degree of efficiency?

Dr. BUSH. Degree of efficiency.

Mr. IKARD. And a matter of morale?

Dr. BUSH. And a matter of morale. The morale is very low indeed, and it is quite natural that it should be. Let me give you an example. I could give you dozens of examples.

I met a week ago a man who was a member of the scientific committee that is advisory to the Security Council, and he said to me, "Well, we have practically stopped working. It is quite impossible to accomplish anything in this atmosphere."

Now, that is the sort of reaction I would get out of 3 out of 4 scientists today. They go on working, but they feel that they are not welcome, that they are regarded with suspicion, that some of the men who led them during the war are now being questioned and their security and loyalty are in doubt. They are like an army without trust in their top leadership or in the political leadership of the country.

Mr. LANTAFF. Sort of a guilt by association complex?

Dr. BUSH. They feel they are part of a group that at the present time is not considered necessary, that they are looked on askance by their neighbors, and they have no enthusiasm, they have no heart for their work.

Mr. LANTAFF. Have you examined the President's Executive order with reference to security risks?

Dr. BUSH. Yes.

Mr. LANTAFF. Do you think that there is something fundamentally wrong with that order, or do you think it is the whole atmosphere which has permeated the Government as a result of certain things you mentioned here today, that have caused its application to be wrong?

Dr. BUSH. I think the basic problem is far deeper than any one move, but I feel that the President's Executive order and the way it has been implemented have been very unfortunate and have increased the seriousness of the situation.

The basic fact is that this country has been going through a wave of hysteria. When people are afraid they do strange things. One of their immediate responses is a tendency to abandon their liberties, they tend to ride roughshod over some of their own fundamental rights. We are afraid in this country, and quite rightly so; we should be afraid in the proper sense in a day of H-bombs; we should be afraid, also, of a situation in which we know that Communists have penetrated our defenses. We have traitors in our midst, and there is reason for being afraid of them. But our fear in this country

has taken the form of a hysteria in which we have gone to extremes, and we have disregarded rights. We have put all our emphasis on preventing some of our secrets from leaking and no emphasis to speak of upon getting some secrets that might be worth leaking and into this situation came the Executive order, and I think it was poorly drawn, has been poorly interpreted, and has made the situation much worse than it was before.

Mr. LANTAFF. That is all I have, Mr. Chairman.

Mr. LIPSCOMB. Do you have any further questions, Mr. McCormack?

Mr. IKARD. I have none at this time.

Mr. MCCORMACK. Doctor, have you any opinion on whether or not research seems to be neglected in the Department of Defense or by the military?

Dr. BUSH. No, I don't think so, not in the ordinary sense. It is certainly not neglected from the standpoint of the amount of money appropriated and spent.

When I was chairman of the Research and Development Board after the war we held the appropriations for research and development at $500 million a year. I was advising the Secretary on it, and I felt that amount was a reasonable level at the time and that, because of the limitations of personnel, to go far beyond that level would result in supporting mediocre efforts and would pour money down ratholes.

Now, the situation has changed since then very decidedly. We have more trained scientific and technical personnel, engineers, and so on; also, many things that were then developed were in the early stages where costs were low. When things get into the stage of hardware the costs will be much greater.

So I feel that quite properly the level of appropriation for research and development in the Department of Defense has gone up, and I have at times felt that it has gone up too much, but certainly I should not take the point of view that there wasn't enough.

Mr. MCCORMACK. Well, my question wasn't addressed so much to that, but I have asked you whether or not, in your opinion, there seems to have been a neglect of the effective use, the development of the teamwork to produce the effective result, either in the Department of Defense or in the military in research and development.

Dr. BUSH. Yes, I think there has been. I think there still is a lack of effort to find out what the really important things are and to put emphasis on them, and support behind them, to see that they not only are developed but also become available for use.

Mr. MCCORMACK. Now, on this advisory body of senior officers within the Joint Chiefs of Staff structure you have testified to, that was a part of one of the recommendations of the Rockefeller report——

Dr. BUSH. That is right.

Mr. MCCORMACK. But didn't the President order the change?

Dr. BUSH. I really don't know. I know that he approved the report.

Mr. MCCORMACK. Yes.

Dr. BUSH. But whether he specifically ordered that step to be taken, I don't know.

Mr. MCCORMACK. But it never has been taken?

Dr. BUSH. It never has been taken.

Mr. McCormack. Now, would these senior officers be retired officers or, in your opinion, should they be retired officers——

Dr. Bush. They could be, and we have some excellent retired officers who could serve; but I feel that it would be preferable to have officers on their last assignment before retirement.

Mr. McCormack. Well, what is usually the period of the last assignment?

Dr. Bush. I think on this matter it ought to be a 4-year assignment——

Mr. McCormack. But, in other words, you would not have it less than 4 years?

Dr. Bush. So the man that goes in there has got 4 years to——

Mr. McCormack. I was wondering—I notice you said "last assignment," and I would assume that applied to a man in active service before applying for retirement, and I was wondering how long a period of time that would be?

Dr. Bush. It should be a man who has shown by his career that he is thoroughly alert to modern development.

Mr. McCormack. But a 2-year assignment would be too short, wouldn't it?

Dr. Bush. Too short. And it ought to be a man, also, who has shown that he can rise above narrow points of view. There are many men.

Mr. Balwan. Would it be proper to ask for the names of men who would be examples of that type?

Dr. Bush. Off the record.

Mr. Riehlman. Off the record.

(Discussion off the record.)

Mr. Riehlman. We have had this understanding with all of the witnesses, that we will provide——

Mr. McCormack. Except those under oath.

Mr. Riehlman. Except those under oath, that we will provide them with a transcript of the hearing. We will permit you to make any revisions, add to or subtract from your statement whatever you would like; secondly, that you may mark as such, whatever portion you feel is of a security nature, and should the committee at a later date make the hearings public they will eliminate that portion which is marked as restricted information.

Dr. Bush. Right. I don't think I have used any classified information this morning. I should be glad to look the transcript over and be sure, but otherwise I am quite sure——

Mr. Lantaff. The only one thing with reference to security that comes to our mind in connection with this and other testimony is this proposition of weakness and the statement of the fact that we are a couple of years behind——

Dr. Bush. Yes.

Mr. Lantaff. We realize that we are talking about the Russian mentality. If we furnished the document which proved that we have fallen down and are behind and that we haven't kept pace and turn on a flat program here, they might feel "now is the time to strike before they do develop," but rather than add to their aid and comfort——

Dr. Bush. I shall be glad to look the record over and be sure we don't give any aid and comfort to the enemy.

Mr. RIEHLMAN. The committee will be very careful in making any document public——

Mr. MCCORMACK. Mr. Lantaff's observation brings to my mind an observation: How far, in your opinion, have the Soviets progressed in the field of research and development?

Dr. BUSH. Well, I haven't any information that is much better than what I gain from the newspapers. Certainly we know this, that the Russians——

Mr. MCCORMACK. Well, I know, but your penetrating mind and background would permit you to go much farther than the newspaper.

Dr. BUSH. I can tell you my opinion. In any field where the Russians can copy a method used elsewhere, they can do so promptly and effectively. For example, they have built good jet planes, having had the jet plans developed in Germany during the war. They built A-bombs; they have built an H-bomb. They have done so on the basis of what they knew of our efforts and what they could produce. But whether they can strike out into new fields and do original things, I rather doubt. I don't think they are that good, but they have an enormous technical program on the way.

There is some indication that they are attempting to train about twice as many scientists and technical men as we are. Now, whether their training is any good or not I don't know. Certainly in Russia today the scientist and engineer are in high public esteem. They are highly regarded and treated by the Government as outstanding citizens who are of great value to the community. They are looked upon with respect, and that means that the ambition of the Russian youth is to get into that group.

I fear that in this country we do not have quite the same atmosphere is regard to our scientists today, but, I don't know; that is the thing on which I am very much puzzled, Mr. McCormack.

I have been to Russia and studied the Russian mentality. I don't believe that the Russians can progress in fundamental science under their machinery at all effectively. I think they can progress in applied science and engineering. They will put all the emphasis on it they possibly can, and perhaps more emphasis than we do, and they certainly can make applications. My question would be whether they could innovate effectively.

Mr. RIEHLMAN. Wouldn't that make our security program more important than ever with that type of background with those people?

Dr. BUSH. Well, yes; we want a good sound security program to prevent the things we know from leaking. We want to have no enemies in our midst, no spies. We want to find them and get them out, of course.

Mr. RIEHLMAN. The reason I brought that up, Doctor, was this—your statement certainly indicates that they will apply their science and their development program to something that they have some knowledge about.

Dr. BUSH. Right. But look at this: If they merely read our newspapers and our technical press and our advertisements they have about all the information they need about what we are doing.

Mr. MCCORMACK. And probably committee hearings.

Dr. BUSH. Let me say this, Mr. McCormack, because I know that is sometimes said. I have had long experience with the Congress, as you know, for 15 years on very confidential things. I have never had

the experience of having anything that I said in a congressional committee leak.

Mr. McCormack. I am glad to hear that.

Dr. Bush. Now, in particular, you and I and one or two other men had some very serious conversations during the war that were about as sensitive as anything could possibly be, and they were entirely secure, so I should like to emphasize that that is not what I am talking about. But in this country—well, I have had this experience time after time. I have worked with a department of the military on a very confidential affair—on a thing I thought was of great importance and felt sure would be held in strictest secrecy—and then I have read all about it in the newspapers.

Mr. Riehlman. Off the record.

(Discussion off the record.)

Mr. Riehlman. Back on the record.

There is one other point. On this development program and incentive for the scientists, Doctor, someone had told us, and I think—was it Webster?

Mr. Balwan. Webster.

Mr. Riehlman. He said that they really have a tremendous incentive program on in Russia at this time to induce scientists to work for the Government and do development work. Do you have any knowledge of that type of program?

Dr. Bush. Only the kind of information that Mr. Webster has, the fact that the Russians have published some of their information.

Mr. Riehlman. Well, he said there were one or two people in the United States that could give us a definite briefing on that and the type of program they have instituted.

Dr. Bush. Yes. I think Dr. Hunsaker, who is Chairman of the National Committee on Aeronautics, is one man who studied that subject quite thoroughly, and he could give you information on it without any doubt.

Mr. Riehlman. I am sorry, Mr. McCormack. I didn't mean to interrupt.

Mr. McCormack. That is what we want, as thoughts come when anyone is questioning, to pursue it at the time.

Mr. Riehlman. Well, I did not want to interrupt your line of questioning.

Mr. McCormack. No; I just wanted to bring out some facts to get the benefit of certain information from Dr. Bush.

Now, what has been your experience, Doctor, in relation to the Joint Chiefs of Staff obtaining the views and not going beyond the views of its individual members?

Dr. Bush. That is quite a question, Mr. McCormack. Now, let me give it to you——

Mr. McCormack. Let me come down to this, then——

Dr. Bush. Let me give it to you straight from the shoulder. I have held important posts in the field of research and development for 15 years, and I have never been called by the Joint Chiefs of Staff for my personal evaluation of such matters.

Now, I have had conferences with them during the war; I have had conferences with them since the war on my own initiative, and I have had conferences with them on other things, but I have never been called before the Joint Chiefs of Staff in connection with scientific

or technical matters, to my recollection, on their initiative to give my evaluation of a technical problem.

Now, I think you will find that what applies to me applies also to scientists generally.

Mr. McCormack. Now, we know about the supercarrier program of the Navy. Have you any knowledge—to take this advisory group that you referred to, a group like that could look over that particular program and its relation as to integrating it with the Army and Air Force, couldn't it?

Dr. Bush. I think it could, yes, and I think more than that, that any such program advanced by one service should be examined centrally by a group that is capable of examining it from all angles to see how it fits into our general national defense.

Such a group should be made up of men who are thoroughly competent to examine, military men supplemented by civilians wherever necessary, but men who are objective, who are unquestionably qualified to look into such an affair and who will look into it solely from the angle, "What does it do to our national defense?"

Now, the same thing you say about our large carriers would apply to the Air Force program of overseas bases. It would apply to the Army program on tanks or any other major program. Any such major program should be examined by some group other than the one who is the projector and advocate of the program.

Mr. McCormack. Do the Joint Chiefs of Staff initiate scientific studies?

Dr. Bush. It has never done so, to my knowledge, except, of course, in its own subcommittees; it has a great galaxy of subcommittees, and the subcommittees examined all sorts of things.

To say it another way, I don't know of any instance where the Joint Chiefs of Staff themselves have instituted, directly reporting to them, a scientific study of any subject.

Mr. McCormack. I introduced a bill—of course, I have introduced various bills in the past several years that I have been very much interested in and concerned with in this whole field. It has troubled me, and the basic thought in my mind was to create, as far as humanly possible, that human organization that would weld the team that would get the maximum result in the national interests of our country. That is, broadly speaking, the one dominating thought in my mind, and it is not only my mind but any American mind.

I am sort of giving you the benefit of my thoughts on this, and I am sure you are aware of the fact I have followed this thing very closely with President Truman in every way I possibly could, not criticizing anyone, but feeling we should try to get, in the constructive way which this subcommittee is doing, the best results humanly possible, and my contribution to it was punching and probing wherever I could, and I introduced bills about assistant secretaries of the Army, Air, and Navy for research and development; also one for the Assistant Secretary of Defense. I am glad to see that has been brought about. I know that there are some additional secretaries in the process.

Have you any views about—not talking on my bill but on the subject itself, because I have no pride of authorship, if we get results for the best interests of our country. Have you any views as to the advisability of assistant secretaries?

Dr. BUSH. I have felt strongly for many years that assistant secretaries would be of great help. I don't think the civilian group in any department can examine into the problems of that department without having as one of its members a man who understands the technical aspects of the problems in the department.

It certainly is absurd, isn't it, that we try to create civilian control of one of the military services by a group of men, no one of whom is in a position by reason of his background and training to understand thoroughly one of the primary aspects of the way of waging modern war, so I feel the man in authority there should be in the position of assistant secretary.

Of course I feel, also, that there should be no question whatever as to where the ultimate authority resides, it resides in the civilian; and operations should be carried on by the military under the supervision of the civilian chief. So the Assistant Secretary of Defense or the assistant secretary of one of the services for research and development should not, I feel, be the operating head of the research and development program. He should be the man who knows all about it, who is entitled to know any aspect of it, and who advises the Secretary so that the Secretary's policies will be established in such a way as to further the effort.

I don't believe that he should take charge himself, but I believe that an Assistant Secretary thoroughly skilled can be of enormous value to the Secretary of the service in exercising his proper control over that phase of affairs.

Mr. MCCORMACK. And from an organizational angle, would that have, in your opinion, a psychological effect in going down the line, in the development of that understanding mind of which——

Dr. BUSH. Right.

Mr. MCCORMACK. The net result is that team we are seeking?

Dr. BUSH. Right. I think there is another thing right there we have erred on for many years.

It is well known in manufacturing concerns that if you place research under production, nothing new is ever produced. Well, the reason is very simple. Anything new that is produced is a headache to the production department, so if the research laboratory in industry is under the complete control of the vice president in charge of manufacturing, that research laboratory will never produce anything. It will merely deal with minutiae in the existing products.

But we very often put research and development under procurement. In the Army our supply services, technical services, are primarily concerned with the purchasing, with the contracts, and so forth, and procurement; and research is under them. I think that is incorrect.

The Air Force has changed the setup and has its research and development quite separate.

The Navy has made one step in that direction which is quite important, for the Office of Naval Research is independent of the technical services in the Navy and reports to the top. But in the Army we still have the situation in which research is buried in half a dozen services. I don't think it can produce under those circumstances nearly so well as if it had its own proper status.

Mr. MCCORMACK. In other words, separate status but coordinated action?

Dr. BUSH. Of course, and coordinated by someone who understands both.

Mr. MCCORMACK. Now, you have referred to the Office of Scientific Research and Development which you headed.

Dr. BUSH. Right.

Mr. MCCORMACK. I think you made some observation to the effect—if I am wrong I wish you would correct me—that that, in your opinion, would not be an effective organization in peacetime?

Dr. BUSH. I don't think it would today in that same form.

Mr. MCCORMACK. Can you give your reason for that, Doctor?

Dr. BUSH. Yes. Such an office developing weapons could not possibly operate without the closest interrelationship with the military, for the development of a weapon involves not merely the work in the laboratory; it involves its integration into the military structure, its test, its evaluation, adoption in training, and various other aspects.

During the war that integration was brought about, but under the conditions of war it was possible to cut corners; and, moreover, the Office of Scientific Research and Development during the war reported directly to the President of the United States and had his vigorous support. Under those circumstances it was possible to bring about a liaison, a relationship under which OSRD worked closely with the military at all points and effectively. Today we do not even have good, cordial interrelationships between the scientists and the military within the Department of Defense. We are lame on that, as I have already pointed out in connection with our security rules, and in the present atmosphere in which it isn't possible to achieve good teamwork between scientific men and military men within the Department, I think it would be utterly impossible to bring about the type of liaison and interchange, and community of interests between an independent civilian agency and the military branches that would be effective.

Mr. MCCORMACK. The British, as I understand it, have an independent service of supply.

Dr. BUSH. Yes, they have a Minister of Service and Supply.

Mr. MCCORMACK. Would you care to comment on the British system and whether or not you think——

Dr. BUSH. Well, more or less surprisingly, it seems to work. The British are skilled in the art of making organizational structures work which seem to me to be utterly incompetent, and they made that one work.

I think their system makes too great a separation between the military branches and their supply, their development. I don't think we should split that wide apart. I do think that within the service we ought to split our research and development from our procurement within the service, and then tie them together within service by the exercise of authority by a chief of staff or deputy to interrelate them; but to split supply into a separate ministry seems to me to be too much of a split, and I think the British generally feel that it has been too much at arm's length.

Mr. BALWAN. In Canada—excuse me.

Mr. MCCORMACK. No, I am asking a lot of questions. I don't want you to think I am taking too much time, but I want anyone while I am asking questions, if they have questions, to ask them so we will have a continuity of thought.

Mr. BALWAN. I was just going to comment on my superficial knowledge of the Canadian system in which they have the research and development department within the Department of Defense as a kind of fourth service——

Dr. BUSH. That is right.

Mr. BALWAN. In which the Director is a member of the Joint Chiefs of Staff, allowing for planning at a very high level of research and development.

Dr. BUSH. I don't know that he is a member, but he sits with them.

Mr. BALWAN. As I say, I have very superficial knowledge, and I don't know that he votes, but I know he sits with them and it provides a very close relationship between research and development at a top level, as well as operating research and development from almost a purely military organization in which the military people are in research and development for the same reasons that we feel we have to rotate military officers into research and development. They are namely, to familiarize officers with research and development, but they are there only for training purposes and familiarity only, rather than for command responsibility as many times we put junior officers and even senior officers—rotate them from a tactical command into working in a research and development operation.

Dr. BUSH. Off the record.

Mr. RIEHLMAN. Off the record.

(Discussion off the record.)

Mr. BALWAN. In connection with that observation on the Canadian system, if that may be followed with a question, "Would you care to comment on the desirability of carrying over some of those ideas into our own American military system?

Dr. BUSH. Canadian?

Mr. BALWAN. Yes.

Dr. BUSH. I don't think I should exactly in the same way. The Canadian system is small compared to ours; the effort in one of our military departments is greater than the entire Canadian effort. I think it would be far better to keep our research and development in each department connected with that department and tie it in there very decidedly with the military thinking and effort, and then provide at the Joint Chiefs level for the integration of those questions which involve more than one department, as most board questions do.

Mr. BALWAN. Well, if I may pursue that just a step farther here, even if we would not want to consider making as radical a change as there would be if we would adopt a fourth service within the Department of Defense. Our experience in discussing some of the problems, is that the individual centers of the service or department show that we do not even have any kind of civilian separation in the centers.

For example, we are looking at the Cambridge Research Center in which they bring in a general who is not a research and development man, but a man who has been in communications, a very complex field, but not a scientific field as such.

Might it not be possible to compromise to the extent that we might have more civilian leadership over research and development at the lower levels, but providing coordination within the Army, the Navy, and the Air Force to superstructures that already exist?

Dr. BUSH. Well, I think we sometimes in this country do a very foolish thing, which we have done for many years. We have a military laboratory which is an entirely civilian effort, manned by civilian personnel, working on scientific problems, and it is headed by a director who is chosen as a man who knows how to carry on such military research although he is a civilian; and then we superimpose on top of this organization a military commander who is in charge of the whole affair and who may not know anything about the way in which scientific research is conducted.

The military services, for some reason or another, have to feel that every one of their efforts is headed by a man in uniform so as to complete the chain of command. I think the reorganization is just an artificial one that comes out of tradition, and it is completely unnecessary in many cases; the thing can be integrated without a superimposed military commander and quite effectively so.

Now, sometimes the organization works well if the military man is a reasonable person and if he and the civilian head can come to a basis of understanding. The atmosphere prevails, however, that for some reason or other the civilian scientific group is not quite trusted to handle military affairs; this causes a good deal of feeling that scientific or developmental projects are subordinate affairs; and that in some way the scientists in military employ has not quite the effect of the man who wears the uniform. This situation is unfortunate, but I have seen it work in many cases.

Mr. BALWAN. The military, in giving their reasons for putting a military man in command, do not state that it is necessary to have a military man as a commander; they usually give as their reason the necessity for making a well-rounded officer and it is required that a good general or a good future general have some familiarity with research and development.

Dr. BUSH. You know the old adage that a little knowledge is a dangerous thing. The assignment of an officer for 4 years to a research laboratory does not produce an officer who understands science. It gives him a superficial knowledge.

I think the old fallacy in the military service was that every officer must be competent in every field, That is still a fallacy, and I think that we have got to come to the time sooner or later when we regard military officers just as we do men in civilian life, as men who specialize in one field or another, who, nevertheless, can go into positions of great responsibility to command, if you please, through any channel, depending merely upon their ability to command. The president of one of our great companies that depends pretty largely upon technical effort does not have to be a scientist or an engineer. He may be a lawyer; he may be a financier; and, if so, he leans on others for technical advice. By the same token, he may be an engineer, in which case he leans on someone else for financial advice.

Some day we may outgrow the theory that a military man must be competent in all fields. But as you know, there is a barrier, and there has been ever since the Civil War, which prevents the officer who specializes on technical matters from going to high commands, and it very seldom happens. If a man in the armed services, an officer, wants to make himself thoroughly competent in the whole field of modern weapons and makes that his specialty, he practically bars

himself from ever holding the highest post of command, and I think that is an utter absurdity.

Mr. McCormack. That brings out the field I was going to ask you about, the rotation of officers in the field of research and development.

We have evidence that in one of the branches of the services it runs anywhere from 1 to 3 years for a commanding officer, and we also have evidence from a very competent source—I think it was Dr. Von Neumann, wasn't it, that said on a 2-year stretch of assignment the first year the man was learning and the second year he was getting his papers ready in that assignment in anticipation of going to his next assignment. I thought that was a rather original observation.

Dr. Bush. Well, my comment is that he is a very unusual person, himself, for that matter.

Mr. McCormack. On the question of rotation, you covered it——

Dr. Bush. Why, certainly we all know that this theory that officers must be given every type of experience possible and that they must be rotated at frequent intervals, causes utter confusion in all sorts of ways.

A contractor carrying out the important program of development for one of the services finds that after he has worked for a year or two he has finally got the commanding officer of that particular service to understand what he is trying to do, and to help him get it done, and to realize its importance. He just about gets to that position when a new officer comes in and he has to start all over again.

Mr. McCormack. For the record—every member of the committee and the staff realizes the importance of it—but for the record, Doctor, will you state your opinion as to the importance of research and development in the world of today, and as you project your mind into the future, addressing it in particular to the military field, how important it is?

Dr. Bush. During the last war the entire art of war was completely transformed. There was more change in the methods of making warfare during the last war than in the entire previous history of military art.

We finally came during the last war to apply science—apply science and technology—to weapons and their uses, and in so doing every branch of warfare was transformed.

The application of science and technology to weapons is not at an end. The safety of this country depends upon our maintaining a very strong Military Establishment of strong military power for many years to come. The strength of that power resides in no inconsiderable degree in the skill with which readiness is achieved, with which we keep ahead of the enemy in the development of new methods and new instrumentalities. It depends upon the skill with which we develop new weapons and the skill with which we make use of that development. If we are going to be safe in this country we cannot neglect one of the primary aspects of military strength, which is the technical aspect.

Mr. McCormack. And we have got to reorient ourselves not only as a people, but the various branches of our defense; the Department of Defense must reorient itself and establish an organization that will not only, first, recognize the importance of research and development,

but from an organization angle develop the finest system humanly possible?

Dr. BUSH. And if we allow any tendency to develop to fight the next war in terms of the methods, the instrumentalities of the last, we shall succumb.

Mr. RIEHLMAN. Mr. Ikard, do you have any other questions?

Mr. IKARD. No.

Mr. RIEHLMAN. Mr. Balwan?

Mr. BALWAN. No.

Mr. RIEHLMAN. Mr. Morris?

Mr. MORRIS. Doctor Bush, in your several comments here on the impact of the security program on scientists, I may have gotten the impression mistakenly, but I wanted to see if I could restate it in these terms.

You have excluded from your comments, as I understand it, the congressional investigations and the particular facets of the Oppenheimer case, and your remarks were directed primarily to the administrative security programs in the executive departments.

I got the impression, perhaps mistakenly, that you distinguish between the two types of information which could be subjected to security programs; one would be the broad types of technical information such as basic research and applied research or production, development and production techniques, in which I get the impression that you felt that no security was possible and, therefor, unnecessary——

Dr. BUSH. Oh, no.

Mr. MORRIS. And let me just finish. And I got the other impression that you distinguish that from, say, tactical or strategic or diplomatic foreign policy information which should be kept secret and can be kept secret, and it raised a question in my mind, if those two aren't so inseparable and interrelated that security should be attempted for both types of information?

Dr. BUSH. If I gave any such impression, let me correct it.

There is no question in my mind that we must have a very effective type of security to prevent leaks of technical matters, diplomatic matters, or any other matters that should be held under secrecy; that we should be very alert that we have no subversives in our midst, no traitors about; that we must have a system that is thoroughly enforced in every laboratory and every military center to preserve the essential secrets.

The system should be an intelligent one; it should be a system that produces the desired effect, that secures results without disrupting the whole operation, without throwing us in a complete turmoil, and without reducing morale to the extent that it has been reduced recently.

We need a good workable security system, don't misunderstand me on that. I do think we are very faulty in many ways. We release things that we should not release throughout the services, and I think we need to give our attention to many aspects of the system to bring it in order.

Now, I think we had a workable security system during the war, and I am proud of the fact that although my organization had in its ranks, oh, a thousand or 2,000 scientists directly connected, and

probably 30,000 if those with the contractors were included, no case of disloyalty in the group has since shown up and no traitor has been named.

In the Manhattan District, which was not under my direct control but for which I continued to have responsibility throughout the war, though there were incidents and though it was quite evident that Russia was attempting to penetrate its organization, the general record for the preservation of secrecy was excellent, as the whole country recognizes. It did a good job of keeping the project thoroughly secret. The security measures taken in the Manhattan District were under General Groves.

In the Office of Scientific Research and Development I was responsible for the security system. It was not a complicated affair; it was a simple matter. It operated with a lot of personal attention to individual cases. There was not a great system of rules; there were not security investigations and hearings and what have you, but the system worked and we had a loyal group, and history has proved that we had a loyal group.

So I believe it is possible for us to have in this country a workable system, a security system, which will produce good results without the sort of scandalous affair that we have had continually before us in recent years and without driving the scientists of this country into a position where they think that their Government doesn't want them and is suspicious of them and where morale is so low that we cease our accomplishments.

Mr. MORRIS. That completely answers my question, but it leaves me with just one more.

We have encountered, and I am sure you are familiar with the fact, as you have mentioned, that there are several different security systems within the Government. For instance, in the Department of Defense there are separate security systems for each Department, one for the Atomic Energy Commission, and presumably other agencies have separate security systems than the FBI and general government.

Do you feel that this duplication of security might well be eliminated and have one procedure for security compliance upon which all agencies could rely?

Dr. BUSH. Well, I know a case of one man who holds a very prominent position, a scientist in this country who has been exceedingly useful to the armed services in various ways; he was a naval officer during the war and turned in a magnificent record. He is—well, was the last time I saw him—cleared by one service and not cleared by another, and I think that is just about as absurd a situation as I can imagine. Certainly we need to have a uniform system.

Mr. RIEHLMAN. Well, Doctor, I would say this to you, that we deeply appreciate everything that you have said and the important contributions you have made to the committee.

If there is anything that you can suggest to us that will help us in this security program in our committee's approach to it, we would be delighted to have you give it to the committee. If you don't want to do it now, when you revise your statement here and take a look at it, if you can add anything at all more than you have said, we would be very appreciative of having it.

Dr. BUSH. I think I have no specific suggestions, sir. I do think that the mere fact that a group of men of this sort understand the

problem and exert influence can have a very salutary effect on the course of what happens, and I also feel that in this whole matter we must lean very strongly upon the leadership of the President of the United States to bring about a better situation in the executive branch of the Government. I hope we shall have the type of constructive leadership that will put affairs in order.

Mr. RIEHLMAN. Do you have any further questions?

Mr. MCCORMACK. No, Mr. Chairman.

Mr. RIEHLMAN. All right.

May I say again to you, Dr. Bush, that we are deeply indebted to you for giving this time and coming up here before our committee.

Dr. BUSH. I want to say that any man in my position who feels as deeply as I do on some of these problems appreciates enormously the opportunity to discuss them with you gentlemen, and I shall feel a little better when I go to bed tonight because I have had this talk with you.

I know that some of you gentlemen are concerned about the very things that I am concerned about, and I think if there are enough people in this country concerned about them we shall see something happen.

Mr. RIEHLMAN. We feel deeply about it.

Thank you very much, Doctor.

(Whereupon, at 12:04 p. m. the hearing was adjourned.)

ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

TUESDAY, JUNE 22, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON MILITARY OPERATIONS OF THE
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met at 1:50 p. m. in room 1501, New House Office Building, Hon. R. Walter Riehlman (chairman of subcommittee) presiding.

Mr. RIEHLMAN. The subcommittee will come to order.

We are delighted this afternoon to have with us Dr. K. C. Black who was here about a week ago to testify about various matters before this subcommittee. Unfortunately, we had to postpone hearing your testimony, Doctor, until today.

The subcommittee wants to insert in the record some of the information about your background and experience which we will be glad to do and I am sure that after the interviews that you have had with Mr. Balwan, who is our staff director, and other members of the subcommittee, and conversing the other day with us briefly, you have some idea of our sincerity in this research and development program and our desire to do something constructive in the way of writing a report on some phases of the progress that is being made and any constructive suggestions that we can make as a committee in this field of activity.

With that statement, Doctor, we will be most anxious to hear what you have to say to this committee about this important subject.

You have a statement you would like to make, or if you want to guide your statement along the lines of the questions the committee has sent up, you have had a chance to observe.

Dr. BLACK. Thank you, Mr. Riehlman.

In talking to Mr. Balwan, the suggestion was that after giving you a brief account of what my technical career and business career has been, that I review some of the details of my activities at the Naval Air Development Center at Jonesville, Pa., and after that I run through the well-considered questions that have been prepared by the subcommittee or its secretariat, and add a few extra thoughts of my own.

Anywhere along the line where there are any questions that any of you care to ask, I will be glad to stop and answer them if I can.

Mr. RIEHLMAN. That is very good. I think probably rather than for me to insert some of this information in the record, as I suggested before, if you will give it personally for the record, then we will have it.

NOTE.—Asterisks denote classified material deleted.

Dr. BLACK. Yes. Mr. Balwan's suggestion was that I run through my own career briefly so that at least you get a time scale of my career and if there are any questions on that we can answer them immediately afterwards.

STATEMENT OF DR. K. C. BLACK, BUSINESS MANAGER AND ASSISTANT TO THE PRESIDENT, POLYTECHNIC RESEARCH & DEVELOPMENT CO., BROOKLYN, N. Y.

I graduated from Harvard College with a degree in physics in 1924 and a doctor's degree in 1927, also in physics. From 1924 until 1929 I was either a part-time or full-time instructor at the same time I was getting the advanced degree.

In 1927, I became full-time instructor at Harvard and during that time I began to get patents in various electronic devices. Actually, although I was in physics, my field would probably be defined as applied physics now that we are getting more specialized in definitions of branches of knowledge.

In 1929, I joined a small electronic instrument company in Boonton, N. J., called the Boonton Research Corp. I was there for 1 year as a physicist.

In 1930, I joined the staff of Bell Telephone Laboratories and was there for 13 years to 1943. Except for the last year there, I was responsible for the development of the electronic equipment that goes on the coaxial conductor system. This was responsibility that grew as time went on from the research to the application stage. This system is the cable network that is used as the backbone of the television circuits nowadays. Television networks are of two types, either cable or microwave radio relay but it was the cable part of it that I was concerned with in those days.

The last year with Bell Laboratory I was in charge of a wartime contract having to do with electronic countermeasures which was the problem of jamming enemy communication, radio equipment.

In 1943, I left the Bell Laboratories and went with Aircraft Radio Corp., of Boonton, N. J., for 4 years through 1947. During the war years I was still working almost entirely in the problem of electronic warfare and in particular the problems of jamming and counter-jamming radio and radar.

In 1949 I was chief engineer for a company known as Air Associates which is best known to people as more or less major suppliers of seat belts for aircraft, although they do a lot of other things, too. It is a small company but it does have that one well-known product.

On the 1st of November 1949 I became chief scientist, although at that time the title was slightly different, of the Naval Aircraft Development Center in Johnsville, Pa. I served there for 3 years leaving in November 1952 to take my present position which is that of business manager and assistant to the president of the Polytechnic Research & Development Co. which is an electronic instrument company in Brooklyn, N. Y.

I think that covers just a time-scale outline of what I have done and where I have been.

During the war, however, I was also a member of two of the committees working for the Office of Scientific Research and Development.

This is the organization under Vannevar Bush with which most of you are probably familiar. They broke their work up into a number of different fields, one known as division 15 was electronic countermeasures, and I was a member of the committee there that directed the Government contracts in civilian organizations for electronic warfare.

I was also a member of division 13 which was the division having to do with communications, although that was a less active committee than division 15 because quite a bit of the work was handled by industry on direct military contracts whereas very few industrial organizations can see much future in making money in the manufacture of countermeasures equipment. So, although they were both important fields, there was more time devoted to the countermeasures than the communication problem.

I was also a consultant in the Secretary of War's Office, Henry Stimson's office, this consultant's job also having to do with electronic warfare.

That was just a common situation during the war. You had a number of different hats which you could wear on different occasions.

Since the war, I have been associated with, in either committee work or consultant activity, first the Joint Research and Development Board; then, when the services were merged, with the Research and Development Board.

Mr. BALWAN. In what capacity were you working with the Research and Development Board?

Dr. BLACK. With the Research and Development Board and also with its predecessor, the Joint Research and Development Board, which was its predecessor, I was a member of the communication panel. Then when I became chief scientist at the Naval Air Development Center I became associate member of the Electronics Committee of the Research and Development Board; and since the abolition of the Research and Development Board, I have been a consultant in the staff of Donald Quarles who, I think, has already appeared before this committee, and who is the Assistant Secretary for Research and Development in the Department of Defense.

So these other jobs have already run in parallel with the regular jobs which have been primary source of income.

Mr. BALWAN. I do not think we have any questions on the background part of it. But if in approaching the next part, which is your work at the Naval Air Development Center, you would give us a little briefing on where Naval Air Development Center fits into the total Navy picture it would be helpful.

Dr. BLACK. Yes. I believe that some of this may be a little redundant because you may have heard it before. But the Navy carries on its technical work under a variety of different bureaus or offices. There is the Office of Naval Research as an example which is the organization to which the Special Devices Center at Washington report. Mr. Bruce Eaton, who gave testimony the last time I was down, was from that organization.

Also, there are the various bureaus among which are the Bureau of Ordnance, the Bureau of Ships, the Bureau of Yards and Docks, and the Bureau of Aeronautics. The Bureau of Aeronautics has as one of its field agencies the Naval Air Development Center. The Naval Air Development Center is supposed to be the Bureau of Aeronautics'

primary agency for research and development; and its commanding officer reports, technically, to the Chief of the Bureau.

Mr. BALWAN. Of the Bureau of Aeronautics.

Dr. BLACK. Of the Bureau of Aeronautics. One has to keep this in mind because the different bureaus are quite isolated from each other and if there is any official cooperation it has to be done through the organization of command. You have to go up to the chief of the bureau who in turn goes to the Chief of Naval Operations, goes to the Chief of the next Bureau and on down. Of course, most cooperation is done informally without going through those steps.

But if one is being strictly organizational, technical work can be rather isolated in these different bureaus.

The Bureau of Aeronautics has, in addition to the Naval Air Development Center, two other principal field agencies. One is the Naval Air Test Center at Patuxent River; the other is the Naval Air Missile Center at Point Mugu, Calif. However, they are primarily test agencies and the Jonesville Laboratory is primarily a research and development agency.

Now, does that give you enough of a picture of how these things fit together organizationally?

Mr. BALWAN. I understand it. The members may have questions.

Mr. RIEHLMAN. Do you have any questions on that?

Mr. LIPSCOMB. No.

Dr. BLACK. The position in the Naval Air Development Center was one of these positions known as a Public Law 313 job. This type of job may have come up several times before this committee or it may not. Are you familiar with what the significance of that is? It was Public Law 313 of the 80th Congress which established approximately 45 positions which were to be outside the salary limits of civil service. These were to be divided equally among the Army, Navy, and Air Force. The particular position as chief scientist of the Naval Air Development Center was one of these Public Law 313 jobs.

At the time I discussed this job with a board which was interviewing candidates for the position, there was no indication of the difficulty that later developed in the case of Mr. Eaton in which there was a change of organization in which the senior civilian position was downgraded relative to the commanding officer. The Bureau of Aeronautics from the beginning put no responsibility in the hands of their senior scientists. They were in a purely advisory capacity so far as the commanding officer of the center was concerned.

Mr. BALWAN. This is standard BuAir policy?

Dr. BLACK. Yes, and this is different from BuOrd which could best be described by Dr. Bennett from Naval Ordnance Laboratory if he testifies. In that system the senior scientist is put in a position of line authority.

Mr. BALWAN. You did not have that?

Dr. BLACK. I did not have that at any time, nor was there any suggestion about it when I took the job. So I mean there was no change during my tour of duty which meant that they were putting the job in a poorer status than when it began.

The difficulties with the position which eventually led to my leaving Naval Air Defense Command were more in the nature of deciding

that the position was really not worthwhile the way the center operated; but I will come to that in a little more detail later on.

So in my case there is no suggestion that the Navy or the Bureau of Aeronautics on the basis of any whim or random change of policy changed the relative organization of civilians versus military people.

Mr. BALWAN. It was bad and stayed bad.

Dr. BLACK. Yes. It was hard for an outsider to appreciate the problems until one had been exposed to them for a period of time.

The reason I took the job in the first place is that the Naval Laboratories, Government laboratories generally, actually control rather a large program expressed in dollars; and a very important program for the country as a whole. I think that one should take these programs very seriously and try to get the most for one's money and try to see that the money is spent wisely and that the programs are intelligent programs.

I think that from a semipatriotic point of view, one thought that one could accomplish a great deal of good. It actually meant taking an appreciable decrease in salary to go to the Naval Air Development Center, but one felt originally that one could do a great deal of good.

Now, perhaps I should describe the Naval Air Development Center in that the organizational structure is significant when one considers why the position of chief scientist from any point of view was not a very worthwhile one. The center actually is an aggregation of laboratories. There is an electronics laboratory. There is an armament laboratory. There was a missile laboratory. There was a medical laboratory at the time that I went there. There also was a naval air station which merely supplies supporting services to the laboratories And since I have left they have added two more laboratories, an instrument laboratory and a photographic laboratory that used to be down at the Philadelphia Navy Yard. So that the center consists of a rather loose aggregation of individual laboratories. These laboratories are under the command of the commandering officer, but they also have missions and functions from the Bureau of Aeronautics itself, so that the commanding officer of a laboratory, if he is given instruction from the commanding officer of the center, may choose to go through his second line of communication to the Bureau and go to higher authority by another channel.

Each one of the commanding officers of a laboratory in turn had a senior scientist who was a GS–14 or 15, if you know civil service nomenclatures; and the problem was that it was a little hard for me as an individual to do anything except to try to encourage people to improve their technical performance, try to find out how to solve problems if you were told what the problems were, but the senior scientist of the center was in no position to issue a command or to control things. You were two steps removed from being able to control anything. In the first place, you would have to persuade the commanding officer to issue a command. In the second place, even his commands in the technical matters were not necessarily binding in that the men in charge of the individual laboratories could claim and this was frequently true, that they were under specific orders directly from the Bureau to do something else.

Mr. BALWAN. That each laboratory have a military commanding officer?

Dr. BLACK. Each laboratory had a military commanding officer and in general he was of captain rank.

Mr. BALWAN. In addition to that, he had a civilian technical man under him.

Dr. BLACK. Yes, occupying almost an identical position that I had with the commanding officer of the center. Again, he rarely had any administrative responsibility; he again was an adviser to the——

Mr. MCCORMACK. What was the technical knowledge and experience of the commanding officers that you observed?

Dr. BLACK. The commanding officers under whom I worked were fortunately all three of them very exceptionally able men. One of them I believe——

Mr. BALWAN. You are talking about the top commanding officer?

Dr. BLACK. The top commanding officer, the commanding officer of the center. He was always a very senior captain. As a matter of fact, of the three commanding officers who were there while I was at Jonesville, one retired on account of disability; the other two both became admirals at the time they left. One of them I believe may have testified here, Admiral Hatcher.

Mr. BALWAN. We have not called him again.

Dr. BLACK. At any rate, there was a possibility that you may have called him. He was the third commanding officer under whom I served.

However, the qualifications of the other officers who were there varied a great deal; tremendously. And if the commanding officer of the center was relieved to go to Washington, and they were whenever there was a selection for admiral, there would be an interregunum when for maybe a month at a time the senior man who happened to be at the center would become acting commanding officer with rather surprising results.

For instance, on the electronic warfare problem I had been serving with an organization known as STAG, Special Technical Advisory Group, under the wing of the Joint Chiefs of Staff. At one time, when Captain Spangler left and before Captain Hatcher appeared, an acting commanding officer was in charge. STAG was supposed to have a meeting at Point Magu on the west coast and the acting commanding officer said, "that is all silly; I don't know what it's about; cancel this thing out." It doesn't help to have continuity of technical work to be subject to the command of a person who is not qualified to understand what the problem is. The actual commanding officers who were put in charge by the Bureau of Aeronautics were invariably very fine technical men who had made original contribution, engineering contribution to things that were useful in the Navy. But this rather heterogeneous crowd of next officers, some were good and some were not; and there was no guarantee that they would necessarily be of high engineering ability.

Mr. MCCORMACK. How long did they serve?

Dr. BLACK. It varied. Of the senior officers, the shortest tour was somewhat less than a year and the longest tour was three years.

Mr. MCCORMACK. What is your opinion about such rotation?

Dr. BLACK. I believe from a military officer's point of view it is not only desirable but necessary, but I believe it is a very poor thing from the point of view of directing a technical program of laboratory——

Mr. McCORMACK. Having in mind the importance of research and development today, and maybe you can project your mind into tomorrow and having in mind the national interest of our country, you have got to eliminate the individual, what might be advantageous to an individual and you have to consider the national interest of our country. What is your opinion about these rapid rotations?

Dr. BLACK. I think that rapid rotation is a very poor thing as far as research and development laboratory is concerned and that it is something that should not exist as far as technical direction of the program is concerned.

Mr. McCORMACK. It is a highly specialized field, is it not, Doctor?

Dr. BLACK. Yes, sir.

Mr. McCORMACK. The quicker the services realize that and adjust themselves to it the better it will be for them and for the country.

Dr. BLACK. That is true. One of the things that can be said is that the very big military advances that have been made have always occurred in laboratories outside of Government control, such as the Radiation Laboratory at MIT during the war, and currently, project Lincoln at MIT, or project Michigan out at Ann Arbor, or have occurred in laboratories where civilian control of the technical program has been rather complete as in the case of the Naval Ordnance Laboratory.

Now, in that case, commanding officers appear and disappear but they do very little as far as the technical program is concerned. They merely occupy the front office and greet the visitors and see to it that the civilian scientists are given adequate support by the Navy, sure that they have enough money and they have enough materiel and that appropriations are handled properly, and so forth. But they do not interfere with the technical program.

Mr. RIEHLMAN. They permit the director in that field to carry on that work.

Dr. BLACK. That has been the case. Dr. Bennett, who is about to appear, can describe the method in more detail. The Air Force has a laboratory called the Cambridge Research Center which used to be operated this way, and I believe you had testimony in regard to this case where there has been a rather marked change in policy in the way that laboratory is handled. The thing that is worrying to a person in my position is that you never can be quite sure that a random change in policy may not destroy the virtue of a laboratory that has been going well for a period of time. If you had called me 2 years ago I would have said that the Cambridge Research Center and the Naval Ordnance Laboratory were examples of a well-run laboratory. But there has been a change in policy with the Cambridge Research Center which has introduced an element of confusion into that operation. There has not been a change in the Naval Ordnance Laboratory at White Oaks. But there is no reason why a change in policy of the Bureau of Ordnance might not do exactly the same thing there.

Mr. RIEHLMAN. Of course, the change in policy comes from the military side and certainly not from the technical side.

Dr. BLACK. That's right. These are military laboratories though, and they are under military control.

Mr. RIEHLMAN. That's right. And following up Mr. McCormack's question about rotating these officers, we have had a lot of testimony in respect to it, and what effect it has had and is having; some of these

officers have been well qualified, others have had no practical background whatsoever. Would the effect be as bad if they would permit these technical directors to carry out their programs properly and not interfere with it?

Dr. BLACK. Yes; I can see no particular reason why the commanding officer of one of these laboratories should not be a military man. However, I think that it would be very beneficial if there were a set of Government policy rules about the management of the laboratory which would rather restrict his power to make changes that were disruptive to the organization.

Mr. RIEHLMAN. In a field that he probably is not qualified in.

Dr. BLACK. That he is not qualified in.

Mr. MCCORMACK. Would it not be better if they were to organizationally develop officers who were qualified to fill those positions, positions of command, and technically——

Dr. BLACK. That would also be good except it comes down to a matter of semantics about one's meaning, about what one means by an officer. If you developed an officer who was destined to be a director of a technical laboratory for long periods of time, that is, 10 years, as long as a director of a scientific laboratory in industry would be, there is a question in your mind whether he is an officer at all. That is, he could not remain proficient at running a battleship or an airplane because he would not have time to go off and do that. So it might be better under those conditions not to say that he was an officer at all but just say he was a civilian director of that laboratory.

These are just personal thoughts. The concept of an officer to me means somebody who can enter into the command of military officers and direct them in the field of battle when necessary. And a technical man in a laboratory cannot keep up his proficiency and remember how to run a battleship.

Mr. MCCORMACK. Is not your military becoming a highly specialized life?

Dr. BLACK. Yes; that is correct.

Mr. MCCORMACK. While your general statement might not be applicable to yesterday, do you think that in the highly specialized world of today and tomorrow that without necessarily departing from it, there should not be exceptions to it? You have the Corps of Army Engineers, for example.

Dr. BLACK. Yes. However, there is this: that at the end of the research and development program one is supposed to come out with a product which can be operated by relatively inexperienced people under the direction of people who know very little about how the product works, but in the period of development, you need to have people who are very sympathetic to technical matters. That is, in the end, may people are skilled in the use of a gun but few people would know how to go about building a gun or developing a better gun.

Mr. MCCORMACK. I was not arguing with you, Doctor; I was trying to bring out your views. We got—we have got to apply ourselves very practically to the world of today and we just have to face the realities of the world. And if it is necessary for the different branches of the armed services to develop a corps of officers who are capable of performing the duties, their duties in this highly specialized field, somebody has to make personal sacrifices for the country's good. All

people have to do that, anyone in a position of responsibility, at some time.

You just said you did it in your own way when you accepted lesser salary because of your patriotism to help your country out; is that right?

Dr. BLACK. Yes.

Mr. MCCORMACK. That is a sacrifice; we all have to do it one way or another. Don't you think that services should develop officers capable in this particularly important field, highly specialized, even if they have to sacrifice being able to command an army or command a corps, or to command a battleship?

Dr. BLACK. It could be done that way; that could be a very effective way of doing it. They would have to give up a military career as we think of it and accept tours of duty of long periods of time, 10 or 15 years, on 1 kind of work.

Mr. MCCORMACK. Or if rotated, they could be rotated into related activities where they would be getting the practical experience of the basic and applied science.

Dr. BLACK. Yes; they could do that.

Mr. MCCORMACK. I can see where you do not have to keep them in a particular limited activity, but where the activity is related and in furtherance of an officer's ability in the field of research and development and the application of it under fighting conditions——

Dr. BLACK. Yes. Now, I should like to introduce a subject which is a little off to the side, but which illustrates my point in a somewhat different way. In the field of the Atomic Energy Commission, they have an organization known as Sandia Corp. which is a Bell System contract to the AEC. It is the organization that works on the atomic bomb other than its explosive part, that is, all the gadgetry that goes with it. This is a civilian organization under civilian direction. In fact, Don Quarles was president before he took his present position of Assistant Secretary of Defense.

At the same time, just across the street from him is a thing called the (AFSWP), Armed Forces special weapons project, which is a military organization. The Sandia Corp. conducts its own work. It is directed by civilians. It has military people in there but they, take off their uniforms and they go in and work as ordinary scientists. The special weapons group is military, has military chain of command and is supposed to study the military problems of handling this special weapon.

I think that they actually accomplish more doing it this way. What you suggested that it might be all right if there was a dedicated officer who was the president of Sandia, Inc., that type of thing, but who was put in there for a long period of time——

Mr. MCCORMACK. My question to you was even broader than that. I did not have any particular project in mind; but the training, we have got to have the military and scientists live with one another, have we not?

Dr. BLACK. That is right.

Mr. MCCORMACK. You agree in general there has to be a military command?

Dr. BLACK. In some of these laboratories there has to be.

Mr. MCCORMACK. They are products of two opposite systems of life.

Dr. BLACK. Yes.

Mr. MCCORMACK. And yet it is necessary for them to work as a team.

Dr. BLACK. Yes.

Mr. MCCORMACK. That is correct, is it not?

Dr. BLACK. Yes.

Mr. MCCORMACK. It requires not only tact, unusual tact, but certainly if the scientists, a military officer, a man in command whom they had respect from the technical angle, that is very important in connection with the developing that understanding between the two groups, is it not?

Dr. BLACK. Very important.

Mr. MCCORMACK. Furthermore, if the scientist and the technical men realize that they have a voice at the higher level of command, it also has a very important effect.

Dr. BLACK. Yes.

Mr. MCCORMACK. Is that right?

Dr. BLACK. Yes.

Mr. MCCORMACK. And so that that relates to the organization?

Dr. BLACK. Yes.

Mr. MCCORMACK. That was really what I had in mind from a broader angle.

Dr. BLACK. I think that what you are talking about is almost exactly the sort of thing which I put in as a recommendation to the commanding officer at the Naval Air Development Center a few months before I wrote a final report here at the time that I left, which was that the commanding officer should be a military man and reporting to him should be a technical director who would be a civilian and that the research and development groups would report to this civilian. The military people would be grouped in support and liaison functions so that if they had to go off to any military phase of their business, they would not interrupt the orderly development of a technical program. Yet, if a young officer came in with rather disruptive ideas on the program, he could not himself disrupt the program; he would have to go to higher authority to have it duly weighed as to whether such a change in the program was worth while.

There are two different philosophies of life between the scientist and the military officer anyway. That is the chief stumbling block here. The military officer has got to be in a position where he exercises absolute command and, even if he makes some mistakes, it is more important that his command be obeyed completely. If a ship is sinking and you are told to go to the third lifeboat, you don't say I think it would be better if I went to the second lifeboat. Somebody has got to take absolute authority and say, do this, and everybody has got to do it.

In research and development it is very important that the person directing research and development be willing to listen to arguments from any of the people reporting to him because there is more knowledge in a group reporting to you usually than there is in yourself.

Mr. MCCORMACK. You find technically advanced officers. As a matter of human association, would it not be easier to talk to one who has technical knowledge, who is an officer, than one who is not?

Dr. BLACK. Very much easier.

Mr. McCORMACK. Would he not tend to act as a technical man? For example, you talk to an officer who is a doctor. He may be a general or an admiral but he refers to himself as Dr. So-and-So.

Dr. BLACK. That is right.

Mr. McCORMACK. They do not refer to them with their title but the doctor.

Dr. BLACK. Where you have the technically competent man, but very often you find that somebody, let us say in the Navy, of lieutenant rank, who has been out of school maybe 5 years, and who just because he feels he should change something, issues a command to a person who has been a Ph. D.

Mr. McCORMACK. I recognize that.

Dr. BLACK. That is the difficulty in an organization like NADC, the Bureau of Aeronautics Center, the military position of authority goes rather deep in the organization and the younger scientists have little recourse because they are subject to the commands of these relatively junior people who are their peers and are not their superiors in the technical angle.

So, I think there is a problem in Government-operated technical laboratories, and that this problem is largely built into the difference of philosophy of life that you find in most officers who do not have the scientific approach. They are reared with the theory of command. Most scientists are reared with the theory that they want to question authority and question the established thing. There is quite a bit of controversy on all this stirring around Washington these days and there is some confusion resulting from it.

Mr. McCORMACK. There is constant search for the truth in new discoveries and in order to do that you have to have marked individualism.

Dr. BLACK. The premium that you pay for a scientist is that you have somebody who is a nonconformist. The great steps that were made in radar were by people who did not believe in the accepted way of handling electronics and they kept trying new things and they developed a whole new art. It was done under civilian control where you did not command these young fellows. You gave them an awful lot of rope and let them hang themselves. Most of them didn't hang themselves. Most of them had good ideas, eventually, and this is hard to do where you have a very strict line of authority among junior people whose principal training in life is that of being in command of a battery, in command of a landing craft, tank, or something of that sort, where they have to learn the standard procedure letter perfect and be able to apply it instantly in times of emergencies.

Scientists would be apt to drown before they could make up their mind how to get off the boat, probably.

Mr. RIEHLMAN. But you are speaking, Doctor, to this committee after having an experience yourself in the field?

Dr. BLACK. My experience was that I thought that I realized what was needed and although there was no authority vested in me in the position I took, I thought that the simple thing to do would be to present good and constructive ideas to the commanding officers, both of the center and his subordinates who are the commanding officers of the laboratories. Then although I could not sign an order, I expected that if you explained things to these people, that they would

sign the orders if orders were required, and in general, maybe orders would not be required, that you would merely give them advice on how to do things and this advice would be adopted. Part of the time this worked but part of the time it did not. And there were these random times when there were gaps in the command of the center when people who did not appreciate research and development programs would be in complete charge.

There also were times when, for instance, any technical report out of the center was supposed to go across my desk. I was supposed to at least see whether the things made sense. This was a case of burying me if you wanted to because one of the jobs of the center was to run qualification tests on electric motors. There might be as many as 10 motors tested in 1 day and each would have a little report written on it. Well, it was just like the old days trying to load hay with a hay loader; you were apt to be buried in this flood of stuff.

Then the story was, well, some reports would not come to me that were important. "We didn't give you those reports because you had not got through with the reports of the day before."

You couldn't even read all the words written in the 24-hour day. So there was no intelligence applied to what we were talking about. A report on the method of handling antisubmarine warfare was one I would want to see. That would disapperar and go to Washington without a chance to check it whereas there would still be miles of these motor reports. There was not an intelligent use made of the position that I occupied. I could not make a command to tell them how to make it useful and at the end of 3 years I recommended that the position be abolished because it seemed to me that unless they granted authority to this position it was better to have these consultation activities vested in the then four, now six senior civilians, each attached to an individual laboratory.

So that was one recommendation I made, that either they change the organization or that they abolish the position because it was not worthwhile carrying a position of that sort at NADC. They did not take the advice. The position has been filled and it is rather recently, and I am not sure how successfully it is working out right now.

Mr. RIEHLMAN. Mr. Lipscomb, do you have any other questions on that phase of Dr. Black's recital?

Mr. BALWAN. I think that in summary, the point that we can make is that they did have a lot of rotation, rapid rotation, of commanding officers at the Naval Air Development Center and that it appeared to be particularly critical in view of the lack of continuity that they had or the lack of authority that they placed in the technical director who could have given continuity.

Dr. BLACK. The chief scientist could have been an instrument for guaranteeing continuity but was never given authority to act as a mechanism for continuity.

Mr. BALWAN. It might have been a mitigating factor in this rapid rotation had the technical director been given more authority to provide the continuity.

Dr. BLACK. That's right. If the organization had been similar to that of the naval ordnance laboratory in which they have had rapid rotation there, I believe, at times, that has never affected the technical

program at all because the technical director has been there for many years, ever since the war.

Mr. BALWAN. Do you have part of your prepared statement to go ahead with?

Dr. BLACK. The one part of the thing that I think that might be—I don't think it belongs exactly in the record but there should be a reference to it, is this final report which I have told you about and which is in the hands of the Bureau of Aeronautics which is this report of the Chief Scientist, NADC, to the commander, NADC, dated October 20, 1952; and a copy went both to the commander and to the Chief of the Bureau of Aeronautics.

Mr. RIEHLMAN. Which was written by you?

Dr. BLACK. Written by me, and was more or less a final windup story of my tour of duty—I formerly wrote one of these each year, an annual report on what I was doing, and things of that sort; this one was written, from a different point of view in that I was leaving. So it was not suggesting what I should do for the coming year; just making general recommendations.

Mr. RIEHLMAN. For the betterment of the project?

Dr. BLACK. For the betterment of the center, yes. This covers a number of other things. One thing that is fairly important is that the——

Mr. BALWAN. May I interrupt just a minute, Dr. Black?

Mr. Riehlman, we have tried to get this document. This document was given to the then Captain Hatcher who was commanding officer at the time that Dr. Black was there. And a copy was supposed to have been transmitted to the Bureau of Aeronautics. Well, the Captain Hatcher at the time Dr. Black was there is now Admiral Hatcher and in charge of the division that the report would have gone to at that time. So we got the same person connected here. We have tried to get this report and Admiral Hatcher has told us that he cannot find it. They are looking awfully hard to get the report. They are having some difficulty getting it. I am not sure that we will get it unless we ask Admiral Hatcher to testify. We originally had Admiral Hatcher on the schedule to testify, Dr. Black, so he could give us his story. In view of the number of witnesses we have had, we have not had a chance to get him here and I wonder if we do want to get him here at all.

In view of that, it might be a good thing if Dr. Black would go through the pertinent parts of that report so we would have them in the report.

Mr. RIEHLMAN. If we are not going to be able to get it, and apparently the doctor feels so strongly about the recommendations that he has made, I would be inclined, if the committee is willing, to have him give us the highlights of the report and the important recommendations that were made.

Dr. BLACK. I do have a copy of the report here although this is a personal copy, and if Mr. Balwan thinks it is worthwhile I could leave this with him.

Mr. BALWAN. Or consider the idea of having this inserted in the record and given back to you as soon as the recorder copies it.

Dr. BLACK. I think so because this whole report is really too long to read here—22 pages. Anybody who feels he ought to study the problem, probably should read this kind of a report.

Mr. RIEHLMAN. If you would be willing to permit us to insert this in the record, I will see that the copy is returned to you by the committee. Without objection by the committee, I would order that to be done.

Dr. BLACK. All right. Let us do it that way. Then I will only touch on a few of the highlights of the report here orally and leave the report with you.

Mr. LANTAFF. In view of the fact that this report is being put in the record at this point, would it not indicate that Admiral Hatcher should be notified of this and given an apportunity to appear?

Mr. RIEHLMAN. I think that is a good suggestion. Certainly in view of the fact that we have endeavored to get the report from the admiral and he claims that it is not available or it is not in the files, he just cannot find it, I think he should be notified that we have secured a copy of it from Dr. Black and that it is in the record. If he has testimony that he wants to give, I think that he should be permitted to appear before the subcommittee. I would think that that would be proper.

Mr. BALWAN. Do you want to leave it on the basis that we will hear him if he wishes to come?

Mr. MCCORMACK. I do not think that we ought to leave it on that basis, but I think it ought to go in the record. If we hear Admiral Hatcher later, all right; if not, all right. Then the members of the committee will have the benefit of it.

Mr. RIEHLMAN. I think what Mr. Lantaff was trying to say is that we tell the admiral that it is here and that if he wants to comment on it, he would be permitted to do it. If he does not do it, we have it for the benefit of the committee. That is the main interest we have, I am sure.

Mr. BALWAN. I have one more point on this. I would like to know what security classification this has, whether it is a confidential document.

Dr. BLACK. It was stamped "confidential," and I was the person who determined the classification, merely to keep it from receiving any wide circulation. This was for the benefit of morale purposes within the center. That is, a thing like this should not receive wide circulation because it could be misinterpreted and in fact some people even knowing of the existence of the document who were just troublemakers at the center, just perennial soreheads, missed the point entirely and felt that I was one of them, you see, and "would you not lead a crusade to upset the center," or something, which wasn't the point at all. This was supposed to be a constructive document to try to point out where things could be improved, and I think things should be done on an evolutionary and not a revolutionary basis as far as an organization of this sort is concerned.

It is classified "confidential" and I do not know what the procedure is for presenting it to you. You do not need to have a signed receipt for these. On the other hand, these things are supposed to be kept locked up. Are you qualified to handle confidential?

Mr. BALWAN. We have facilities for maintaining and keeping classified material. The problem that we have at this time is, if this is classified "confidential," because it contains information of a security nature which pertains to the national security, that is one thing; but if it is confidential in the form of administratively confidential,

then we would not feel bad about revealing the document. In the last resort, I think that if we included that and if the committee should decide to print the hearings, we would check with the Department of the Navy to have them tell us whether the material we have in that is, or contains material pertaining to, the national security.

Dr. BLACK. I think that actually from a formal point of view, it would be more correct for you to obtain the document from the Navy anyway and I see no reason why you should not be able to do so in that there were a number of copies in existence at NADC.

Mr. MCCORMACK. We have you before us and you have it and I think we are entitled to it.

Dr. BLACK. But the point is that before it is published——

Mr. MCCORMACK. We thoroughly respect the executive but we expect the executive to have respect for the legislative. I am very strict on respecting the authority of the executive, but this appears to me that you put the confidential on it yourself.

Dr. BLACK. Yes.

Mr. MCCORMACK. You can take the confidential off. That was not put on by the Navy Department.

Dr. BLACK. As long as we understand the basis for it. So I will leave this document with you.

Mr. RIEHLMAN. I think that the staff director has made a very constructive suggestion to me and I will present it to the committee. It is that we accept this document from the doctor and insert it in the record. If we are able to get one from the admiral, we will insert the one of the admiral's in lieu of this one if that is satisfactory to the committee.

Mr. MCCORMACK. I do not see where that should be excluded from the public printed hearings on the evidence that we have. Apparently, from what the doctor says, it is constructive proposals and it is pertinent to our inquiry. And I assume that the doctor when he made it thought that if his suggestions were adopted it would improve the situation.

Dr. BLACK. Yes; as a matter of fact, some of the suggestions have been adopted so it is not entirely a lost cause.

Mr. MCCORMACK. Without that document, if you were here, as you are, and any one of us asked you questions about the contents of the document, you would answer them.

Dr. BLACK. Yes. I could answer practically paragraph for paragraph right now, right through, and put it all in the record. I could read this to you without violating national security.

Mr. MCCORMACK. We can waive the reading and then it is just the same as if you had read it. We can put it in the record, just the same effect as far as the hearings are concerned as if you read it because we are going to read them.

Dr. BLACK. I will leave this with Mr. Balwan, then.

Mr. RIEHLMAN. I think we will do it this way if it is agreeable, Doctor: we will accept the report and have it printed as a part of the record and if the record is made public at some later date by consent of the committee, we will then check with the Navy to find out if there are any portions that are of a security nature, and if so, it can be stricken from the published portion of the hearings. If not, it will become a permanent part of the record.

Mr. McCormack. With the understanding, of course, I assume, that with respect to, that we respect the views of the Navy but they are not binding upon us.

Mr. Riehlman. That is exactly right.

We are going to act in a democratic way.

Mr. McCormack. I just said that for the record so the record would be clear.

Mr. Riehlman. I am very happy that you did, and we want it clear.

Now, if you have some pertinent parts which you would like to comment on at this time, you may do so.

Dr. Black. Let me tell you the sort of things in it. I just skipped through headings in this thing, and if there is any one heading anyone wants amplified, we can amplify it, but I do not want to amplify them all; otherwise, I would read 22 pages.

But there is a review of the duties of chief scientist, particularly in relation to certain problems peculiar to Government laboratories. That is what I have been talking about, the problem of inability to be effective, the effective use of my time, where one has no control over what is done with the suggestions.

There was a little point here called civil-service attitude. There is a popular impression outside of Government circles, an attitude which is a combination of clockwatching and trying to get away with anything; tremendous preoccupation with echelon and position and feeling you can never get fired for doing nothing, only if you make a mistake. This attitude does exist to a certain extent. It is particularly aided by some unimaginative supervision, both civilian and military, and so forth. The expression heard several times at NADC does much to abet a civil-service attitude.

Mr. Balwan. Have they asked you scientists to punch a clock or sign in?

Dr. Black. I will come to an interesting point in that a little bit later on.

The people of the engineer status did not punch clocks at NADC although this thing perpetually keeps coming up. It is a steady battle for anybody in a position of scientific responsibility.

Then there was prejudice against Government employment. That is the fact that Government employment is looked upon as a disgrace by many people in the scientific world because they feel that you only do that if you cannot do something else.

Mr. McCormack. Is that a feeling among the scientists?

Dr. Black. Quite common; yes. It is a very unfortunate thing. To sum things up, it is a common impression that people who are willing to put up with the various indignities of working in a military laboratory, must be pretty hard up. That is the general attitude in many places. And I know of certain personnel directors of technical groups in civilian industry who will not hire a person who has ever had a tour of duty as a civil servant.

Mr. Balwan. In contrast to the feeling they have in Britain.

Dr. Black. Yes; complete contrast to that where the civil servant is a very much-honored person. The civil-service scientist is usually one of the highest, most respected scientists that you can find in Britain; and it is also a very unfair thing here in this country to denounce, categorically, civil servants because some of our most illustrious scientists have been in civil service: Harry Diamond who

was responsible for the first all-weather air navigation system, still used by all aircraft here, was a civil servant. Michaelson, who made the most elaborate measurement of the speed of light was a civil servant. You can go through a tremendous list of outstanding civil servants. So it is not a fair thing. But yet, this is the word that gets around and it does infect some personnel directors who say this is a reason for disqualification. Of course, they would not publish that, but when they are choosing their employees it is important.

Then there is a note on the lack of productivity. That is, there is too much nonproductive work done in a place like Jonesville.

Mr. BALWAN. How would you illustrate that?

Dr. BLACK. It is a common impression that Government laboratories are relatively nonproductive, that is, one gets relatively little—in dollar value—out, for the dollars that go in. This, I am happy to say, is not always true. Specific groups at NADC, might be guilty, in NADC as a whole there appear to be a large number of unproductive——

Mr. BALWAN. Individuals?

Dr. BLACK. Individuals who are usually productive but who are forced into rather lengthy periods of nonproductive work, such as position-description writing, for an example. This is a thing that is a combination of Navy and civil-service requirements. You find people who spend maybe 2 or 3 days trying to write a story about what they are doing. And it is always a very plushy story when you get through because they are trying to explain why they should get a promotion. They spend their time thinking about that and working with that rather than doing what they are supposed to be doing.

Then there is inability to make effective progress against the problems discussed in these programs. Although some days you seem to make progress, at some times you cannot.

In summary, one of the reasons for my decision to leave NADC was that I felt that in spite of my ability to see the problems discussed just above, my connection with the administrative authority in NADC was too remote to be able to make me in my position sufficiently effective. That is the summary of this first section.

Mr. BALWAN. Your feeling on that is that the position is too far removed to make any person holding that position effective, not necessarily you.

Dr. BLACK. That was my feeling, that is why I thought I should leave, because I did not think that I was earning my money or giving the country full value for my salary, and I did not think that that position should really exist unless there was change in——

Mr. BALWAN. What salary at NADC?

Dr. BLACK. $13,500; that I think, had been raised to $14,000 but that happened since I left.

Mr. MCCORMACK. Is that base or gross?

Dr. BLACK. That is total annual take. I think in some mysterious way I lost 4 cents a year. In my present job, I am gaining 2 cents a year, so eventually I will even up.

Then there was another section here on the comments on the vitality of the technical establishment. This was a recommendation of things that should be done. As a matter of fact, I have quite extensively quoted largely from a talk given by Dr. Ralph Boun who

is director of research at Bell Telephone Laboratory. He gave a business-management talk and I merely cribbed a group of headings and pointed out how in each case improvements could be made at Jonesville if they would try to achieve a vital organization.

This goes through a number of points and the summary of this is that some rules for continuing and increasing the vitality of a technical institution have been presented by a director of research of a very large, and well known and successful research and development laboratory.

In reviewing these rules it is evident that NADC is deficient in these ways which I set forth but these fall within the control of the Bureau of Aeronautics or the Secretary of the Navy. If possible, some assistance can come from the Congress.

There is one little thought here which is very important in the operation of a Government laboratory and that is recognition of the dignity of an individual. My comment on this heading actually is cribbed from some notes by Dr. Ralph Bennett. "Recognition of the dignity of the individual is inadequate at some research and development laboratories. In some instances, the overmeticulous observance of military courtesy has resulted in officers of low rank being treated with greater deference than nonmilitary technical people of high rank. This is a very serious thing and I think that is one thing that should be established. If one is going to keep a social situation correct, it is necessary to have a semiequivalence of rank and treatment of civilian staff and the military staff. Unless you had help from a military officer, the civilian usually came in at somewhat below the enlisted man in the choice of quarters and other things, or if you were traveling by military conveyance, the same rules might apply. This, you might think, is a small thing.

Mr. RIEHLMAN. I suppose that would be true on a military operated base, would it not?

Dr. BLACK. Yes; if you have an officer who can carry enough weight to set up the rules of courtesy, that is all right. But if you were traveling on your own, you would have nothing unless it were written into the travel orders on which to base accommodations.

Mr. BALWAN. At what equivalent rank would you be quartered at Point Magu when you traveled to Point Magu?

Dr. BLACK. In order to avoid this—I am answering this in sort of a double-headed way—in order to avoid this I generally tried to avoid having military quartering; but it would be purely up to the decision of the commanding officer.

Mr. BALWAN. You couldn't avoid it at Point Magu because there is no place to go.

Dr. BLACK. I stayed at the house of the senior scientists. But take the naval air station in Dallas where we usually run out of gas on a transcontinental trip; there it was purely up to the commanding officer of the station to determine what accommodation you would get.

In international usage there is some equivalent rank that has been set up but this is not generally recognized within the country.

Well, then, I give suggestions about the reorganization of the center, but we have talked about that. There is no need to go into it. There is a suggestion for improvement of fiscal policies which has been done, by the way. Some recommendations have been accepted.

I think I have covered most of the other points here.

There are some things peculiar to NADC as a center that would not be generally significant to this committee but it is a little hard to separate them out.

Now, the question of the treatment of scientists is a rather important one. I just want to mention two examples, since we were on that subject. One affected the attempt to hire a very well qualified technical man and one was involving a matter personally and I throw it in for fun.

One of the problems that I had there was trying to get good, senior technical men to come to work at NADC. We were always in need of more people. At the end of the working day there was always a made scramble to get out of the place. It happened that leaving a certain gate which I always did I usually turned left to go home. This particular time I had a scientist who was just about ready to sign up with NADC. But I had to turn right as I left the gate in order to get him to a train. He had practically agreed to come to work for us. I had never faced this before, but suddenly a marine says, "Hey, you civilians, don't you goddam fools know you have got to turn left?" I had always turned left because that was the way I went home. It hit this fellow. He says, "I guess I will look for another job somewhere else."

Well, I commented and the situation was corrected. But it was just due to the instructions of some junior officer who had come into the picture. These were some of the guard force who were under military control and probably always would be under military control. Somebody just thought it was a good thing to fix up the traffic pattern but it cost us one good scientist.

Mr. RIEHLMAN. The traffic pattern was that civilians turned to the left?

Dr. BLACK. Officers could turn right or left as they saw fit. That was the difference in the social scale.

Mr. RIEHLMAN. A very important decision.

Dr. BLACK. It sounds silly, but it did cost us one good scientist. If you were running a research laboratory for General Tire & Rubber Co., you would probable fire somebody forthwith if they persistently made silly decisions like that to antagonize the help unnecessarily. Therefore, in times of fire maybe you should turn left. I don't know. But he could have even worded it differently, so it would not have been so objectionable. This is the kind of thing that goes on at military establishments.

Mr. RIEHLMAN. That did not affect that scientist but apparently it had been ranking many of those people who had been following that regulation, probably, and I am sure it would disturb me if I were a good scientist and waked up to find that there was a requirement that I could only turn left.

Dr. BLACK. There was another little one, just since I have given you a few little anecdotes—there was another one; it affected me. On account of this terrific traffic jam it was as much as your life was worth to be in the corridors at 4:31 because the mad rush for exit was terrific. There was a traffic jam; you could never get out of the place. So it was habitual that I just worked late. It wasn't any credit to me, but you couldn't get out anyway so you might as well go on doing some work. So although quitting time was 4:30, I left around 5:30 or quarter to 6. This was routine, week in, week out.

At one point fairly late in my career, our chief patent man was leaving, going to private business. So there was the usual farewell lunch which ran approximately 2 hours instead of 1. So I received notice that I was being docked an hour of annual leave for this thing. I had put in many hours, many more hours in any given week. I complained to Captain Hatcher about this but I never got the thing reversed. So it is a case of taking of a senior technical man and putting him on a time clock and not giving credit for extra hours worked. So these little things do get around.

So, you see, once a military man makes a decision, it is very hard for another military man to reverse it without loss of face.

These things make it rather difficult. The average scientist who makes a decision that is wrong, or who makes a mistake, will, if you come to him with it and explain matters, say, "Let's fix it up." But you don't do that in a military organization. Once a decision is made, it is a rather painful thing to change it. This is another factor that is difficult because in scientific research and development you are always finding out you were wrong the day before and you wish you had done something else. And you have to make changes.

So I will leave this with you right now.

The other thing I thought, if you would like, I would run down these question here.

Mr. RIEHLMAN. If you would, please.

Dr. BLACK. Are there any characteristics inherent in military organizations which are incompatible with administration of an effective program of scientific research and development?

I think that there are certain things that make it characteristically difficult to operate under military control. I might remark that it is a little embarrassing because, working for Quarles' office I know the gist of Quarles' testimony on this point and I am afraid that as I go through this there will be a good many cases in which I seem to be disagreeing with what he has said. I think the thing is, that there are detailed differences between the point of view from somebody who has worked inside the organization and somebody who is looking at it from the outside, if you see what I mean. I know in answer to this question his attitude was generally there is not anything inherently wrong. But actually, I think there is. The operation of at least one organization that he has directed has demonstrated this point. And I don't think any Government laboratory would have accomplished what has been done at the Sandia Corp. for the same price.

Mr. BALWAN. Mr. Chairman, on that point, you might say that that remark is not at all different from the responses we have received from scientists all over the country.

Mr. RIEHLMAN. I think that is true.

Mr. BALWAN. You are not unique and you should not feel that you are complaining in any way.

Dr. BLACK. Does the military organization of the research and development program tend to create conditions to retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?

I am quoting NADC experience and I can say, "Yes." I have given you a few instances of the type of problems that arise.

Mr. LANTAFF. Do you think that those were inherent in the problems and that one is characteristic, or do you think that it is a question of individuals involved, more or less lack of leadership?

Dr. BLACK. I think that it is inherent if you allow the authority vested in officers to go, organizationally, deep into the scientific group, I think it is inherent in that case because with all the best intentions in the world, if you have rotations of those officers, many of them, you are bound to have some who do not understand the principles of good personnel management.

Mr. LANTAFF. So it is the policy of rotation that you refer to when you say that it is inherently difficult.

Dr. BLACK. I think that you would find this true in General Tire or Bell Telephone Laboratories, that if you rotated the supervisors every 1 to 3 years, that you would find that those organizations would degenerate quickly.

Mr. BALWAN. Is there anything about the method by which a military organization has to be run? In other words, the Navy has Navy regulations and issues orders from the commanding officer; the Army has its own regulations for governing a post. Are the difficulties just inherent in the way the military organization has to run, aside from rotation?

Dr. BLACK. I think there is some of that, too, although I think that one might be willing to put up with some of those difficulties; that is, their accounting practices are determined by the Congress. They may be somewhat different from the accounting practices in industry when they have a research laboratory. Certainly, in my laboratory we have stockrooms in which it has been proved much better to let people steal their fill of certain number of small items and don't keep track of them. You can't do that in a military establishment because you are responsible to the Congress, eventually. I think that is right. I think Congress should have this rather direct control. We accept some inefficiency in certain things just in order to have a working plan that is applicable throughout, across the board. But those things, I don't think they are those things that really hurt the effectiveness of the laboratories as much as these other things, these personnel problems that arise.

Mr. RIEHLMAN. Does that answer your question, Mr. Lantaff?

Mr. LANTAFF. Yes.

Dr. BLACK. Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are met?

I feel that in my opinion that the major research programs could better be done by civilian organizations with military liaison officers, like the Sandia Corporation with its associated Armed Forces special weapons project, like Project Lincoln at MIT, like Project Michigan.

Mr. BALWAN. Do you think NADC could be run that way, or is that peculiar in any way that it would not lend itself to that type of operation?

Dr. BLACK. NADC has within it programs which could be administered in a standard military organization and which require no high-level civilian personnel. There is a motors-testing laboratory, for instance. It only requires technicians to do their work, and that could

well be done under military control. It could be done at Patuxent River which is the Naval Test Center. The reason it doesn't get down there, I imagine, is that it happened to get started at NADC. It is an economy to use it there rather than build a new building at Patuxent River. That, I think, could be done under military control.

I think study of antisubmarine warfare by aircraft could very well be done under a civilian organization, which is one of the big programs.

Mr. LANTAFF. In other words, you have in mind that the scientific work could be advanced by letting these out on a contract basis, similar to the projects you mentioned?

Dr. BLACK. As an example, I would say that the work, the true development work, not the testing work, but the development work done at NADC could be done on the basis of a contract by the Navy with the University of Pennsylvania or with the Philco Corp., just to name two specific organizations. One could be an industrial contract and one could be an educational contract.

Mr. LANTAFF. I can imagine, however, the importance of having military people who are responsible for policy in the development of the work.

Dr. BLACK. That would be just as it is in Project Lincoln. It is an Air Force contract. I know the navy delegation at Project Lincoln and the project there relies very heavily on the military people who are associated with it.

Mr. LANTAFF. That would be integrated into this project by assignment to perform certain tasks?

Dr. BLACK. Yes, and the Navy supplies destroyers; it supplies blimps; it digs up 5 to 8 radar installations in a hurry somewhere for the project to use. But the man who determines which way the scientist turns, which way he drives his car out the door is somebody from MIT.

Again coming back to these little things, if a fellow at MIT tells the naval officer that his idea is screwy, he doesn't get docked 5 days' pay because the idea might be screwy; at least you listen to the case.

Mr. BALWAN. Along that line there, we have had testimony in which the military people have told us that they agreed that you might have some civilian control or that you could give this work under contract to civilian agencies if it is on the research end of the spectrum of their work; but the closer it gets into the development part, the more military it has to be.

Now, since Johnsville is a development center, how would you feel about that?

Dr. BLACK. I would feel that there through the development stages, it could well be still a civilian-controlled organization. I think it is very important that at some place along the line the military get it and they tear it to pieces, but the Navy has such an organization known as the Operational Development Force, a fleet down at Norfolk. It has samples of every kind of battleship and cruiser and weapons carrier and so forth; that they actually take the development models and try them out with fleet personnel under fleet conditions. Rarely does a developmental device go through with their test without a lot of things having to be done to make it good. The Operational Development Force are the ones who are going to have to use it and they should be under military control. They can have civilians employed there who work as servants of the military. That is all right.

But the thing is, that is not a development agency. It is a suitability testing agency.

Mr. RIEHLMAN. Would you agree, Doctor, that there should be some research and development programs carried on by the military and not farmed out to other people?

Dr. BLACK. There will always have to be some military laboratories. Just because there will be new problems arising in new fields that are not allocable to any of the existing contracts. If some laboratories are under their own control, they can start work on a new project with practically no notice, you see. So there always will have to be some laboratories of this sort but there in turn if some of these other conditions are met they will be better laboratories.

I think that NADC can be run as a military laboratory if it were run according to the rules of the Naval Ordnance Laboratory. In scientific circles, the Naval Research and the Ordnance Laboratories and the Bureau of Standards are all accepted as fine organizations and except as to the extremely bigoted, there is no taint connected with employment by those laboratories.

Mr. BALWAN. May I make a suggestion? Dr. Black is going through these questions. I am sure he could provide even better answers to the questions if he could submit those in writing in the interest of saving time.

We have Dr. Bennett. I think it might be advisable to have him give us his picture on the thing. Would that be acceptable to you and Dr. Black?

Mr. RIEHLMAN. Yes; if the doctor would be willing to submit answers to the questions in writing, we would appreciate it very much.

Dr. BLACK. I will send them to the chairman of the committee.

Mr. RIEHLMAN. That will be very helpful and we certainly appreciate having your thoughts on these questions. I am sure that you probably could elaborate on them better if you had time to write them up rather than give them orally.

Dr. BLACK. I will write you out a little story on these Arabic and Roman numeral sheets here.

Mr. RIEHLMAN. May we insert those in the record at this point?

They will be inserted at this point in the record.

(The statement is as follows:)

QUESTIONS AND ANSWERS RE RESEARCH AND DEVELOPMENT PROBLEMS

1. Are there any characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development?

Although in a broad sense, military organizations do not have characteristics which are incompatible with the administration of an effective research and development program, the practical observation is that, in most cases, military organizations do not conduct research and development as well as those of private industry, universities, or nonprofit research institutes. The word "incompatible" in the question is probably somewhat too strong. The fact is that the rotation of officer personnel in most military establishments leads to a sense of insecurity on the part of individuals and to lack of continuity in the technical programs. Furthermore, it frequently happens that military personnel of less scientific and engineering experience is put in charge of civilians with greater experience. This does not necessarily lead to trouble but it is frequently the case.

2. Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?

The answer given to question 1 above is generally applicable here. In addition to the points raised in answer 1, there are additional problems which make it difficult to retain the services of highly qualified personnel. In some military establishments, the treatment and courtesies accorded civilian personnel are in no way commensurate with the treatment and courtesies accorded military personnel of the same experience. In many military establishments, senior technical personnel do not feel they are given the authority and responsibility comparable to that which they would obtain in nonmilitary establishments, and hence there is a tendency for those who can obtain more responsible positions elsewhere to leave Government service. It should be emphasized that this occurs in many cases where money is not necessarily the controlling factor in such a move.

3. Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?

It would be impossible to answer a direct yes or no to this question. It is my personal belief that a larger number of the military research and development programs can well be administered by civilian organizations than is now the case. It is also just as certain that some military programs should remain under direct military control. In case a civilian organization administers a military program, military needs would be met by liaison arrangements similar to those that existed for Radiation Laboratory during the last war, at Project Lincoln now, and at the Sandia Corp. for the last few years.

4. Would it be feasible to organize military research and development programs in such a way that the technical activities capable of being performed by a civilian organization could be separated from those which are purely military, such as support functions? Where military support activities are necessary in connection with a research and development project, and such activities must be under a military commander, does it necessarily follow that the technical research and development functions must also be under direct military supervision?

In a good many cases, it is my opinion that the answer to the first half of this question would be "Yes" and the second half "No".

5. To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs? To what extent should private, nonprofit institutions participate? To what extent should private industry participate? How much "inhouse" research is required for the military services to be capable of exercising qualitative control over research and development conducted by outside laboratories?

In my opinion, the Department of Defense could contract more extensively with nongovernmental institutions to carry on their military research and development programs. Depending on the specific problems, decisions could be made as to whether it should be carried on under an industrial, university, or nonprofit organization auspices and there are existing examples of programs being carried on by each of these three types of organizations which are proving to be quite satisfactory.

There are two additional questions to which I am giving the numbers 6 and 7 respectively, which I would like to ask and answer in order to amplify the answers given to the first five questions.

6. Is civil service employment detrimental in laboratories carrying on military research?

In some cases, civil service has introduced problems which interfere with the orderly pursuit of research and development programs. It is difficult to discharge or dispose of mediocre personnel when they achieve relatively high civil service rank. It is also true that civil service puts ceilings on salaries, which tends to make positions unattractive to the better people who regard salary as an important factor. In spite of this, it is possible to have laboratories with high morale and a good reputation that are staffed by civil servants.

7. Are the civilian salaries in military research and development organizations an important factor in preventing the hire of high grade personnel?

Undoubtedly, the existing salary limitations in civil service have caused many individuals to leave or to avoid Government service. However, it is possible to find skilled personnel who are sufficiently devoted to their work or who have a patriotic motivation who will overlook salary limitations if certain of the other difficulties mentioned above can be avoided. It might be desirable to establish a code of treatment of civilian scientists in Government laboratories which will be recognized throughout the Department of Defense and which would encourage all high grade civilian personnel to remain in Government service.

COMMENTS ON "REPORTED PROBLEMS IN MILITARY RESEARCH AND DEVELOPMENT PROGRAMS"

I. Civilian scientists in military research and development centers are reported to be generally dissatisfied with military domination and administration.

Although it is frequently difficult to be sure that all people will express themselves on this subject honestly before an investigating group for fear of damaging their own positions, it is my belief that in many military establishments the senior civilians resent military domination and administration and that such domination and administration tends to encourage the exodus of the more highly qualified technical personnel.

II. Civilian scientists are leaving military research and development centers in a general exodus.

Testimony has been given before this committee that the turnover in technical personnel in Government institutions is approximately the same, or slightly less, than that for industry as a whole. This would indicate that there is no general exodus from military research and development centers. However, these statistics are apt to be misleading. There is a tendency for older civil servants who are within 5 to 10 years of a generous pension to stick to their jobs regardless of the opinion which they may hold in regard to the efficiency of administration. In addition to this, the large bulk of junior scientists and engineers have not yet risen in the organization to a point where the problem of military versus civilian control is significant, hence, the group to be considered is the relatively small group of highly qualified civilian scientists or engineers who occupy the upper echelon positions and who have not yet built up enough years of civil service seniority that it is simpler to work under any conditions in order to guarantee a suitable retirement arrangement. In this small group there is a much higher turnover than in industry as a whole.

III. When a military organization is imposed on a research and development program there is a tendency for the military to expand its control over technical decisions and operations in the research laboratories.

There are many examples in which the truth of this is demonstrated and these can be selected from a wide field of Government laboratories.

IV. Military research and development officers are not scientists who command the respect of the civilian scientists.

Certain military research and development officers command the highest respect in the scientific and engineering world. However, there are many other officers who reach positions of responsibility in military organizations who do not command this respect and who are given positions of authority.

V. The policy of rotating assignments for military officers militates against the retention of officers who in some cases have the training, talents, and disposition to guide scientific research centers.

The policy of rotation of officers is discouraging in those cases where a well trained officer is replaced with one who is less qualified. On the other hand, to perform their duties as officers and to exercise command of military organizations, it is hard to see how one can avoid having rotation of military personnel.

VI. Research centers often are organized and administered as military organizations with the attendant restrictive forms, procedures, regulations, and military discipline which do not provide the optimum climate for research work by civilian scientists.

This statement is true in a fairly large number of military establishments.

VII. The lack of either a definite or consistent policy for organizing and administering research and development centers leaves each center at the mercy of each change in commanding officer and executive. This creates an instability with no assurance that even the well-run research and development center will not become, with a change of officers, an unbearable situation.

This is frequently true.

VIII. Several outstanding civilian scientists who have been associated with military research and development programs are reported to be in favor of changes in the governmental organization and administration of these programs.

Suggestions along this line have been made from time to time. Furthermore, the services themselves have, in some cases, made moves in this direction. The establishment of the Lincoln project is one example and it is my impression that the management of the long-range Missile Proving Ground at Cocoa, Fla., is being transferred from direct military to industrial supervision.

IX. The funding of research and development is confused when handled with military budgets. Direct research and development costs are justified to and appropriated by the Congress as such. However, this does not give a true picture

of the actual total cost of military research and development programs inasmuch as there are substantial indirect costs arising from military support functions in the form of pay for uniformed officers, provision of capital facilities, and certain maintenance and operation expenditures.

In this connection, it is reported that it is often felt necessary to build up a research and development center with such support functions in order to make it "respectable" in terms of size and complexity as a command for a colonel or general. This, in turn, sets off a vicious cycle in that the existence of military support elements becomes a further excuse for military domination, more officers, regulations, etc.

The statements under IX are frequently true. However, it should be observed that large industrial civilian organizations frequently have similar troubles and it should not be assumed that the single expedient of moving the administration of military research programs from military to civilian hands would necessarily cure the situation.

Mr. RIEHLMAN. So that you will understand exactly how the subcommittee will work with the testimony that has been given, you will be provided with a transcript of your testimony on which you can elaborate and make any corrections that you would like to. If you find in reading it over that you feel that any portion of it is of a sensitive nature and you want it as confidential, you mark it and then if the document is eventually made public that will be deleted from the public portion of the record.

Mr. LANTAFF. From a security standpoint.

Dr. BLACK. I think we have kept off pretty well anything except administrative problems but I will read it with that in mind.

Mr. RIEHLMAN. Do you have any questions of the doctor?

Mr. LANTAFF. No.

Mr. RIEHLMAN. Mr. Balwan?

Mr. BALWAN. No.

Mr. RIEHLMAN. We want to again thank you, Doctor, for giving your time and giving the subcommittee the benefit of your views.

The committee will come to order.

The committee is fortunate this afternoon in having Dr. Ralph Bennett, who is Technical Director of the Naval Ordnance Laboratory at White Oak, Md., to give us some information in respect to the manner in which this laboratory is operated. I understand that the testimony that the doctor will give us this afternoon will be quite enlightening to the committee in this respect: That he feels they are operating under ideal circumstances and conditions up there, and we have heard contrary to that about some other laboratories since the committee has been hearing different witnesses and people who want to give testimony in respect to this research and development program.

May I say to you, Doctor, that we appreciate your being willing to stand by at the call of the committee and we also want to apologize for having you here once before and not being able to hear you at that time.

I see that you have a prepared statement. Do you want to read that to the committee or would you rather elaborate on it and let us insert the whole document in the record?

STATEMENT OF DR. RALPH BENNETT, TECHNICAL DIRECTOR, NAVAL ORDNANCE LABORATORY, WHITE OAK, MD.

Dr. BENNETT. This statement was prepared in answer to the material the committee sent me about problems which had come to the attention of the committee in the Government. I think the statement

speaks for itself. I could, however, say a little bit in a general way about the policies and about the philosophy of our operation.

Mr. RIEHLMAN. I think that would be very helpful and we appreciate that.

Mr. BALWAN. If I may interrupt before the doctor gets going, I think it would be helpful for the record if Dr. Bennett would give us a little bit of background on where he went to school, previous employment and experience and how long he has been here.

Mr. RIEHLMAN. I am sorry. I had intended to do that. We did that with Dr. Black and if you will give us that information it would be very helpful.

Dr. BENNETT. I was born at Williamson, Wayne County, N. Y., and went to the public schools there; educated at Union College and the University of Chicago, with postdoctorate work at Princeton and California Institute of Technology. I have taught at the University of Chicago, at Union College, and at MIT.

I came on active duty in the Navy in 1940, and spent 7 years in uniform. In 1944, I was made Technical Director of the Naval Ordnance Laboratory, a position I have held since that time, and for the last 7 years as a civilian.

Mr. BALWAN. Are you a physicist or a chemist? What is your profession?

Dr. BENNETT. I was trained at Union College as an electrical engineer, and at the University of Chicago as a physicist.

Mr. BALWAN. Thank you.

Mr. LANTAFF. Did you say that you had had military service?

Dr. BENNETT. Yes, in the Naval Reserve.

Mr. LANTAFF. Are you in the Naval Reserve now?

Dr. BENNETT. I am inactive.

Mr. LANTAFF. What rank do you hold?

Dr. BENNETT. Captain.

Mr. BALWAN. Along that line, you reported for active duty in the Navy; did you report to the Naval Ordnance Laboratory?

Dr. BENNETT. I reported to the Naval Ordnance Laboratory, and spent my entire service years there.

Mr. BALWAN. You spent some time in the Naval Ordnance Laboratory as a military officer?

Dr. BENNETT. Yes. The Naval Ordnance Laboratory had been approximately 95 years under various names in the Gun Factory when I joined its staff, and it expanded from about 50 people to about 2,000.

The concept of the White Oak plant was born as a result of some of the problems we had working in the Naval Gun Factory.

Mr. BALWAN. Did you come to the Naval Ordnance Laboratory on active duty as the Director of this laboratory?

Dr. BENNETT. I came as a lieutenant commander and assistant to the commanding officer who was commander at that time.

Mr. BALWAN. Did you ever direct the laboratory as a naval officer?

Dr. BENNETT. Yes; I was in command for a month in 1943 as a naval officer.

Mr. BALWAN. Then you became civilian Director or chief scientist?

Dr. BENNETT. In 1947.

Mr. RIEHLMAN. All right, Dr. Bennett, if you will proceed.

Dr. BENNETT. The pattern for the development of new weapons has come out of our experiences in World War II. It seems to me that in our important developments, this pattern has taken this kind of a shape. We get new weapons, sometimes as a result of a need being recognized by an officer in the fleet, and that need satisfied sometimes as a result of suggestions from officers, but very often, as a result of a suggestion on the part of civilian scientists or engineers.

The other route by which we get new weapons is by the evolution of new scientific principles, and the understanding on the part of scientists or engineers of the possibility of applying these new principles to warfare.

In the first place, the technologist is required to understand what science and technology can provide to meet the solution of the military problem.

In the second case, the military officer is required to be able to tell whether the technical concept will be useful, or can be made into useful weapons for the Navy. It takes these two professional groups working together to evolve new weapons most rapidly and most effectively.

That is, we must have naval officers in this picture and we must have civilian scientists and engineers. The problem at the Naval Ordnance Laboratory, when we saw that we were going to have this magnificent White Oak plant, was to tie together these two kinds of professions into a working organization which would give the Navy good weapons rapidly and inexpensively. That was the problem of the Naval Ordnance Laboratory when it was established at White Oak.

We have here members of two professions, both of them proud professions. The profession of the naval officer is a proud one. He looks back in our Navy to John Paul Jones, to Decatur, Bainbridge, Hull, Farragut, Dewey, and Sims, and in World War II and in our own time, Halsey and Nimitz—a proud profession with a great tradition.

However, the scientific profession is also a proud one with a great tradition. We look back to Galileo and Newton, Farraday, James Clerk Maxwell, Lord Kelvin, and in engineering people like Marconi, Ford, Edison; and in our own day in science we have men like the Comptons, Lawrence, Einstein. This, too, is a proud profession, with a proud tradition.

Neither one of these sets of professions, or these groups of professional people, is well suited to serve as the "hired hand" of the other. This, to me, is a very important factor in this situation. The two groups can work best as partners. And the concept of the naval ordnance laboratory was that these two groups of professionals should be set up as partners.

When World War II ended, we had on board a rather better than average technical staff, brought to the laboratory as a result of patriotic incentive. The problem was to set up a system of operation which would retain a fair share of the quality of this staff and, in the future attract more men of quality, and would, provide a working arrangement whereby these two groups of professions could work effectively together. Recognition of this problem was embodied in the operating principles which were evolved at that time, and of which I have a number of copies here.

I would call to your attention what I consider the more important of these. No. 3: "* * * a positive integrated program which the laboratory has a share in planning." This means that the laboratory people, both military and scientific, have a share in deciding what is worthwhile and what is worth doing in our laboratory.

Mr. BALWAN. To what extent do you share in planning at levels above the laboratory at the Bureau of Ordnance?

Dr. BENNETT. Our share in this, by the nature of the situation, must be limited. The thing we can supply is the scientific and technical knowledge, and to point out possibilities. Naval officers, by and large, have to decide whether a device which we suggest is feasible and useful to the fleet. We recognize this. They are the users. They must decide whether a development is worthwhile. To the extent that we can supply technical information, we do have an important share in putting together this program. We try to insist, and I think with fair success, that the military requirements be put to us, but that the technical solution is our job. The Navy tells us what is needed—that part of the Navy which decides these things above our level. We decide how technically to meet the requirement. But it requires an exchange of information and ideas back and forth all the way up and down the line to make this procedure most effective.

Principle No. 10: "The commander and technical director are jointly responsible for the effective and economical internal functioning of the laboratory." This is perhaps the most important principle.

Mr. RIEHLMAN. Joint responsibility between them.

Dr. BENNETT. There is never any question that the final responsibility is in the hands of the commander, a military man. But the more completely we can approach this partnership the better it seems to work; and we have done this very successfully in the laboratory at White Oak because by this process, as technical director, in a partnership, the Navy's problems are my problems. They are the problems of the technical staff, as well as the problem of the naval officer. This gives a real responsibility to the civilian scientist and offers a real challenge. It gives the technical man a real job. He has a sense of responsibility and he will work much more industriously, much harder, and usually much more successfully if he has this real feeling of responsibility for getting the job done.

I might mention also No. 12, because one of the problems brought up was the ballooning of a station in order to provide things which were perhaps unnecessary, but add to the stature of the commanding officer. This has not happened at our place, because in principle 12 you see that the function of the service departments is to aid in supplying the needs of the technical staff for accomplishing the work specified by the technical director.

We have a very real say in how much shall be spent of our income on services, and on things which might not be essential to the technical program. This, I feel, is the key to economical operation in our place. The technical staff, and its management determines how extensive these services shall be.

Mr. LANTAFF. Subject to being finally passed upon by the Director of the laboratory.

Dr. BENNETT. The commanding officer has the final responsibility and the final say.

Mr. LANTAFF. The technical staff, though, has the final responsibility and the final say? That is, subject to being finally passed upon by the Director of the laboratory?

Dr. BENNETT. The commanding officer has the final responsibility and the final say.

Mr. LANTAFF. The technical staff initially makes up the proposed budget?

Dr. BENNETT. Specifies what it needs to do its job. We put together on a semiannual basis a work plan which assigns to our tasks manpower, and money, and services.

Mr. LANTAFF. How about the expenditure of those sums? Are those expended, then, by the commanding officer and his service staff?

Dr. BENNETT. Technical Director signs the directives for the spending of money on the technical program.

Mr. LANTAFF. That authority is vested in the Technical Director?

Dr. BENNETT. The way we operate, it is.

Mr. LANTAFF. I think that is the only laboratory that we have run into that does.

Dr. BENNETT. This makes the responsibility of the Technical Director real.

Mr. LANTAFF. In other words, it is his responsibility to see to it that the budget is not exceeded and that the funds allotted for certain projects are expended for that purpose. What happens if there are excesses?

Dr. BENNETT. We have a headquarters staff which runs the police action on this to keep track of it, but if there is any contention it comes up to the Technical Director. But here again——

Mr. LANTAFF. Is that delegated now to the director, Technical Director, by the commanding officer?

Dr. BENNETT. Yes, sir.

Mr. LANTAFF. How long has that been in effect?

Dr. BENNETT. This has been in effect since 1947.

Mr. LANTAFF. I noticed this directive is dated December 1951. But that relationship had existed prior to that?

Dr. BENNETT. This set of operating principles has had minor changes in it since it was put in force in 1946. The changes had to do with item 7; that is, we have assigned to our laboratory 5 or 6 postgraduate ordnance officers who are back from sea duty and can bring to us the latest fleet information, background and know-how. We have been in the process of evolving the best method of using these extremely helpful officers. There are the changes that have been brought about in this set of operating principles in our operation. The rest of it is essentially unchanged.

Mr. LANTAFF. I notice that this set of operating principles has been approved by the Chief of the Bureau of Ordnance. From that, do I understand correctly that all comparable naval establishments, naval laboratories, are operated under the same type of instructions?

Dr. BENNETT. I think the Naval Ordnance Laboratory and the Naval Ordnance Test Station are the only ones which have a set of operating principles of this sort in which the responsibilities of the senior technical man and the commanding officer are spelled out specifically. Naval Ordnance Test Station is at China Lake, Calif.

Mr. BALWAN. Do they operate under the same operating principles?

Dr. BENNETT. They have a set of very similar operating principles patterned after these.

Mr. BALWAN. Have they experienced difficulties in their operation which you have not?

Dr. BENNETT. Yes, they have. Their establishment is bigger, and all of their problems are bigger, and the operation is much more difficult and they have had more troubles.

Mr. BALWAN. Has their Technical Director had the same amount of leeway as you have?

Dr. BENNETT. I feel that, by and large, he has.

Mr. RIEHLMAN. Well, could you give the committee some illustrations of the problems that they have been confronted with that are different from yours?

Dr. BENNETT. They have an area somewhat larger than the State of Rhode Island to worry about. Their command is divided between Pasadena and China Lake, which is 160 miles out in the desert. They have to run a town of about 12,000 people. They have had on their station until recently a fairly sizable production operation for the Atomic Energy Commission. They have a pilot loading plant which is quite a different kind of thing; the number of employees has been around 5,000. These all make for complexities, difficulties, problems which we have not had to face.

Mr. RIEHLMAN. We are primarily interested in a working arrangement between the Technical Director and the commanding officer.

Dr. BENNETT. I feel that our type of operation has a serious weakness. It depends very completely and in a very real way on cordial relationships between the Technical Director and the commanding officer. Any time if there is a cross of personalities in that area the station is in for trouble.

Mr. RIEHLMAN. Do you think that personalities are possibly more at fault for the problems than the military direction?

Dr. BENNETT. I feel so from the way our place works and the way Inyokern works. I think perhaps the personal problem is the most dangerous one. But I see no other laboratory or station of this type which I have felt is working better, or really as well as ours. So we put up with this danger but we have a——

Mr. LANTAFF. Have you had more than one commanding officer there since you have been Technical Director?

Dr. BENNETT. Glennon, Schindler, Whitington, Beatty, Hanlon, Schindler, Woodyard, since I have been there.

Mr. BALWAN. Seven?

Mr. LANTAFF. Seven different officers.

Dr. BENNETT. The same Schindler in both cases.

Mr. RIEHLMAN. He was rotated in this position. What field of activity did he go into, do you know, after he left this laboratory?

Dr. BENNETT. Admiral Schindler left the laboratory to take command of the cruiser *Topeka*. I am not sure what his next duty was. He had another command and came back. He had some sea duty and some shore duty.

Mr. RIEHLMAN. Did he have any technical background?

Dr. BENNETT. He is an ordnance postgraduate. But these commanding officers of Naval Ordnance Laboratory have been line officers, seagoing men, all of them. Their interest and career lies not in

science and technology. It lies in the fleet and learning how to use the fleet effectively.

Mr. BALWAN. Are there officers in the Navy with other designations than standard line officers who sometimes do have technical backgrounds?

Dr. BENNETT. The engineering-duty-only officers have technical backgrounds. They are not qualified to command at sea.

Mr. BALWAN. Do you have any assigned to this NOL?

Dr. BENNETT. I think we may have had 1 or 2 in junior capacities.

Mr. BALWAN. Might it not be better to have technically qualified officers rather than line officers?

Dr. BENNETT. I feel that our method of operation is better because we depend on the technical staff to carry the continuity and to provide the science and technology. And we do this with people who are full-time, recognized professional scientists and engineers.

On the other hand, we have naval officers whose business is to fight the fleet and whose career lies in the seagoing end of the Navy. They do not pretend to be scientists or engineers. They bring to the laboratory a seagoing flavor which is essential in order that we develop weapons that can be used by the fleet. They bring this information from first-hand direct experience. The commander, the assistant commander, and the ordnance application officers are all men of this type.

Mr. BALWAN. You respect consumers of these products, in other words?

Dr. BENNETT. Right.

Mr. BALWAN. Would you have any objection to having—what do you call them?

Dr. BENNETT. Engineering duty only?

Mr. BALWAN. EDO's. The thing I am driving at—I think you understand this—is that the staff has heard in talking with the Navy people, that there is a conflict between scientists and EDO's, whereas the scientists do respect strictly line officers.

Dr. BENNETT. I think that if we had engineering-duty-only officers assigned to the laboratory, this might complicate our picture and perhaps make it more difficult to carry on the kind of operation we have, because with line officers on the one hand and civilian scientists and engineers on the other, the areas of operation of these two groups are more clearly defined. There is less chance of crossing boundaries and getting into each other's territory and causing confusion.

Mr. BALWAN. Are you an EDO?

Dr. BENNETT. No; I do not have that classification, although I am certainly not qualified to command at sea. The Reserve does not distinguish one way or the other.

Mr. RIEHLMAN. Do you as technical director, Doctor, feel with your experience and background that you are qualified to know what goes on in all of the laboratories that are under your direction?

Dr. BENNETT. I always say that I am very rapidly approaching the complete bureaucrat which is one who knows less and less about more and more. I am very close to knowing nothing about everything. But I have three assistants, plus the assistant commander who in a way is responsible to me. I depend on these people to follow three main areas of operation in the laboratory. They in turn, each on the average, have three assistants who cover smaller areas, and I do not by

any means attempt to keep myself familiar in detail with the work of these 2,850 people.

Mr. RIEHLMAN. You don't feel that it is absolutely necessary for a civilian director to, and would it not be very difficult to find a director that was qualified to, follow all of those activities?

Dr. BENNETT. My job is to try to provide an atmosphere and a means of operation which will make these 3,000 people effective. Whether I know about the nuts and bolts in this fuse or that mine, is of very little importance. But I do know how to get hold of somebody who can tell me. So, much of our effort at the Naval Ordnance Laboratory, these 10 years, since White Oak became a reality, has been spent in trying to adjust the civil-service system and the Navy system to the effective operation of this laboratory, that I have gotten a long way from scientific details. But I do feel that we have made progress in the evolution of a system which can use 3,000 people effectively in this kind of an operation. I feel that with the help of some very sincere and very helpful and interested industrial friends we have been able to teach ourselves how to do this cheaply and economically, and I think we have had some measure of success in keeping a spark of inspiration, tied to the great traditions of the Navy, which has made this a reasonable effective operation.

The people who work at the Naval Ordnance Laboratory, I think, by and large, like to work there, and a good many of them will volunteer an opinion that they like to work there. I do not think the complaint level is very high. I think we have a good spirit, and the inspiration in this whole thing is the background and the tradition of 150 and more years of successful performance on the part of the Navy. We try not to forget that. We are part of this picture and in mid-century, the atomic age, we can make a very real, important contribution to this great tradition. This is the thing that spurs us on.

Mr. RIEHLMAN. The main reason for my asking that question is that we have had testimony on this matter of whether or not a civilian technical director should be qualified to know what goes on in all of the different laboratories that he has supervision over. I would expect that you would agree that the great qualifications of the man would be that he could place in key positions men of competence to whom he could go to get the technical information he needs in order to be well versed in what is going on at all of the levels underneath him.

Dr. BENNETT. It is far too big an operation for any one man to become entirely familiar with in detail. I would feel that a technical director was not doing his job if he tried to do this.

There are 3,000 people. It cost, $100,000 a day to run our place. How can we get the most for our money? How can we make the efforts of these people effective? How can we inspire these people to do their best work? It is not the nuts and bolts that are my important problem.

Mr. RIEHLMAN. Are you having a problem in getting scientists into your organization?

Dr. BENNETT. We have a very serious problem which I feel in the course of a few years more will destroy what we have been able to build, if it isn't changed. We do have turnover, and we do have people leaving. We train them well and they go into industry, which is a national asset. We would not mind such loses, except that our ability to attract high quality young men is fast disappearing

because of a discrepancy in our pay scale between what we can offer what we call a "fresh caught college graduate" and what industry can offer the same man. The differential is nearly $100 a month.

In a very few years the strength will go out of our organization unless we can continue to bring young men of ability, real ability, into it. If we can do that, if we can build them up and train them fast enough, we can continue—otherwise not.

Mr. BALWAN. I can see how that differential is probably more accentuated in the lower levels. Is that as true in the upper levels, say, the grade 14 man who makes $9,600 in the civil-service scales? Is he a scientist who can go out and make $15,000 in industry?

Dr. BENNETT. The rate which moves them from the laboratory now is approximately 50 percent above what we pay. In that level we do have 14's going out and getting approximately $15,000 a year.

Mr. BALWAN. It takes about that much to get them out?

Dr. BENNETT. On the average at the present time that would be my estimate, about a 50-percent differential.

Mr. RIEHLMAN. But you are losing scientists and your fear is that unless there is some correction made in this pay scale it is going to be a very serious situation?

Dr. BENNETT. I feel it is vital at the low end to get ourselves nearly into equlibrium with our competitors money-wise. If we can get within 5 or 10 percent of it, I feel that we can make our laboratory attractive enough so we can get the people we need. As it is now, that differential is too great.

Mr. BALWAN. Are there any other factors which make it difficult for you to get scientists?

Dr. BENNETT. There are many things of an evolutionary nature about the operation of these laboratories which can be improved. I think we can do this in time. We have only been going about 10 years. This is a one-generation proposition, to build these great laboratories into the naval system in order to run them effectively. There are a lot of little things that could be changed but I think this pay problem is a pretty important one right now. It is in the front of our thinking.

Mr. LANTAFF. You think the work of your laboratory could be done equally as well or better by a comparable organization which is a private civilian firm operating under contract with the Navy?

Dr. BENNETT. At the Naval Ordnance Laboratory we have technical supervision of about $20 million worth of contract work which is done in industry. This is very important. We would not think of trying to operate without this support. It is especially useful where skills are needed which we do not have, equipment is needed which we do not have, and where things can be put together in a reasonably neat package and handed to the industrial establishment as a package and a defined job. This industrial help is vital for our successful operation. This is the way we get manufacturing know-how, modern American manufacturing know-how, into the producing of our designs. But I do feel that a laboratory such as ours has a unique place in this picture because we succeed better than in any other way in bringing these two groups of professions together and bringing their knowledge, their know-how, and their abilities to bear on these problems which are part naval and part physical science.

I do not see any way that an industrial organization as they exist in this country at the present time, can do this part of the job as well as we can. There are other parts that they can do better.

Mr. LANTAFF. You do rely to a large extent on contracts with private firms for your research and development work?

Dr. BENNETT. Very largely. We find that the ideal method when we have a new weapon to develop is to bring in a contractor very early, and preferably a contractor who has extensive production facilities, and work together in the evolution of the design. When that design is evolved, then it is suited, if he is a good contractor, to modern American manufacture and it can go right into his plant and come off the production line relatively promptly.

This is the ideal way to do it. Contractual laws and regulations do not always permit. Sometimes we can do it this way, very quickly, cheaply, effectively.

Mr. LANTAFF. About what percentage of your budget is allocated out by contract to private industry?

Dr. BENNETT. We do not contract money out ourselves. This is done by the Bureau of Ordnance.

Mr. LANTAFF. Not chargeable to your budget, in other words?

Dr. BENNETT. No, but ordnance assigns us technical direction for some of these contracts and at the present time the amount of money spent under our technical direction is about equal to the amount of money spent internally in the laboratory. This means that we guide the efforts of roughly 1,000 professional people outside. In each case about two supporting people are required for each professional in either organization.

Mr. LANTAFF. In view of your description of the nature of your duties as Technical Director, would it be your opinion that the Technical Director should be primarily a man with high administrative qualifications and the ability to handle and manage people, or do you think that he should essentially be a scientist or technician who possesses part of those qualities? The reason I ask that question is because we have had that situation arise, as was mentioned earlier, in 2 or 3 other laboratories where it was said that the primary requisite here is administrative and not technical. Therefore, you do not need the scientist in positions as technical director. The opinions before this committee are varied on that point. What would be your opinion?

Dr. BENNETT. The way this seems to work in American industry, if you want to run a successful research and development organization, you almost invariably find it necessary—or at least industry does—to put into these leading positions men of established scientific reputation. If you look at the Bell Laboratories, it is Dr. Mervin Kelly, and Dr. Bown and Dr. McRae; if you look at General Electric it is Dr. Guy Suits; in Westinghouse, Dr. John Hutcheson; all scientifically trained men but men whose interests and abilities have gone beyond pure science and have led them to learn or to use abilities they already had in the direction of the efforts of others. I think this is the kind of man we must have in positions like mine if the laboratory is to be effective.

Mr. LANTAFF. In other words, they have to have a scientific background in order first to evaluate the workload and then apply the work of the people, as well as to command the respect of the people?

Dr. BENNETT. Right. The quality of the people we can attract to the Naval Ordnance Laboratory is very intimately connected with the quality of the senior technical people. If these men are well trained, men of established reputation, then this automatically attracts able young men, because they look to these people for the furthering of their careers. Unless they see a group of recognized scientific and technical ability at the head of a laboratory, it is very difficult to get young men to come into the organization.

I think this vital to successful operation. I think it is proved by the way American industry works. Every one of these great laboratories in industry is headed by a well-trained scientist, and the senior people are all well-trained scientists. They are administrators primarily. I do not know of any great laboratory in which the senior staff is not sprinkled with well-trained technical people acting as administrators.

Mr. LANTAFF. Doctor, I understand that the statement which you have prepared and in which you respond to several direct questions and statements of the problem prepared by the committee will be included in the record. While I have only had the opportunity to scan through that, I understand that your testimony is considerably different than the testimony of other scientists who are appearing before us. Yours is an optimistic statement; you think that the present system and relationship between the military and the scientist, insofar as the particular laboratory you are connected with is concerned, is highly satisfactory. However, being in the scientific profession, do you think that the present relationships between the military and scientific group are good today?

Dr. BENNETT. This would be a very broad statement to say they were or were not good.

Mr. LANTAFF. It is a broad question.

Dr. BENNETT. I think in some areas they are very good; in other areas, as we have evidence, they have not been so happy.

Mr. LANTAFF. In the areas where you have evidence that the relationships have not been harmonious, or happy, do you know the reasons for that?

Dr. BENNETT. I am sure that personalities enter in some cases. This is bound to be true in any human operation.

Mr. LANTAFF. Under the best system personalities would be involved.

Dr. BENNETT. Yes.

Mr. LANTAFF. And the rotation system, I gather, is one that is also involved?

Dr. BENNETT. The rotation system has not so far proved a serious difficulty in our laboratory.

Mr. LANTAFF. Insofar as your laboratory is concerned?

Dr. BENNETT. Yes. It does have in it a danger, but this must be viewed in the light of the overall objective, which is broader than our laboratory.

Mr. LANTAFF. Have you noticed any particular difficulties in your laboratory in operating under the security program?

Dr. BENNETT. Well, the security program requires a lot of thought and care, but I don't see any way to avoid having the security program, and I think it is reasonably well administered. Perhaps we

could improve it in detail, but there is no getting away from it in the kind of a world we live in.

Mr. LANTAFF. I think unquestionably we do have to have the security system. Do you think that the present system is designed not only to protect the security of the country, but also to achieve the maximum in scientific working conditions? In other words, scientific bodies and scientists like to have a free interchange and exchange of information, each with the other, so that they can use the progress of someone else in order to further their own scientific adventures. Do you think that the security system impedes that to a dangerous degree?

Dr. BENNETT. I think it impedes this interchange, but I don't see how we can avoid it.

Mr. LANTAFF. You think it is a necessary——

Dr. BENNETT. I think it is a necessary evil.

Mr. LANTAFF. Evil?

Dr. BENNETT. But I would like to say that in our laboratory we have a very large share of the responsibility in the intelligent administration of this in what we publish and what we say and where we say it. It is part of our responsibility. It is not a thing that is imposed blindly. We have a responsibility in this. In my opinion this is probably about as good as it can be. We lose time because of the time required for investigations.

Mr. LANTAFF. Have you had any scientists under your direction or control who have been cleared under former loyalty programs but have been refused clearance under the current Executive order under which you are now operating?

Dr. BENNETT. We have had, of course, re-examinations, but I don't recall a case where this was done. We have really very little difficulty with this problem.

Mr. LANTAFF. That is all the questions I have.

Mr. BALWAN. I have only one question. Do you consider the Naval Ordnance Laboratory to be a development laboratory or a research laboratory, or at what end of the spectrum are you?

Dr. BENNETT. The Naval Ordnance Laboratory covers the whole spectrum. We do some research, which is rather basic; and we think it is important. The Bureau of Ordnance gives us the latitude to do this. We do a great deal of applied research. We do a great deal of engineering development. We do testing and evaluation of our own designs and our daily bread is earned by the evolution of the engineering designs for weapons or components whose design disclosures are ready for manufacture by American industry. So we are a research and development laboratory and cover the whole range.

Mr. BALWAN. Would you say you are more in development than research? We understand that ONR is in basic research to a large extent, and when the bureaus come into the picture, they are more in development.

Dr. BENNETT. Well, this is a matter of opinion as to just how much we are in research of a basic nature. If you ask a physicist qualified to judge I would expect he would say between 5 and 10 percent of our effort is of a pretty basic nature. The rest of it is applied research and engineering development, and design and evaluation.

Mr. BALWAN. Would you say it makes it any more difficult to operate a military laboratory which is more development than research?

Dr. BENNETT. I feel it is more difficult to operate this kind of a laboratory. But development must, by the nature of these establishments, be their main job. At least establishments such as ours.

Mr. BALWAN. Does it make it any more difficult to have civilian technical direction in an organization which is primarily development than in one which is more research?

Dr. BENNETT. I think on the average perhaps it does, because the further you get along toward development and design, the more important is the contribution of the naval officer—the user. This might make it more difficult, but this has not been a serious problem with us.

Mr. BALWAN. It has not what?

Dr. BENNETT. It has not been a serious problem with us.

Mr. BALWAN. Would you say that the Naval Ordnance Test Station is more development than yours and therefore the problem of a civilian technical director is greater?

Dr. BENNETT. I think that they probably have spent a larger fraction of their effort on research of a more basic nature than we have.

Mr. BALWAN. Size would be a factor there?

Dr. BENNETT. But the extraneous problems are the things that make the administration of NOTS so difficult. This town with everybody living together and the desert surrounding it.

Mr. BALWAN. That is housekeeping, but could it not be in the hands of the military? It is like a lot of housekeeping at NOL.

Dr. BENNETT. It can be, but this has a very important bearing on the contentment of the people. If they are unhappy they are not productive.

Mr. BALWAN. I don't understand the full import of your answer there. Could you elaborate more on that?

Dr. BENNETT. I think sometimes it is very important who gets the next house that is available. And unless the technical staff has something to say on this kind of a problem, decisions might be made which are arbitrary and might heighten the discontentment of the technical staff.

Mr. BALWAN. So a civilian technical director should have more responsibility than just the technical direction, as you have in your principles here, with respect to some of the housekeeping problems.

Dr. BENNETT. This involves principle 12 on the extent of the size of the service departments. They should be adequate to meet the needs of the technical program, and no more. The problem of the technical director, as I see it, is to make these people productive, and they will not be productive in this kind of work, which requires individual initiative, unless they are reasonably happy. So everything that bears on their happiness and contentment is a problem of the senior technical staff, and there is no doubt about it.

Mr. BALWAN. Could not some of that be done by a steering committee composed of the chief scientists of each one of your directorates or divisions?

Dr. BENNETT. Frequently it is done that way. Of course this side of our problem is very small. We have very few houses.

Mr. BALWAN. Could not your technical work be done by a steering committee advising the commanding officer, rather than through a permanent technical director?

Dr. BENNETT. Yes. I think it could be done. There are many ways it can be done. I just don't feel that anybody else has hit the situation quite so successfully as we at NOL up to the present time.

Mr. LANTAFF. I will certainly gladly agree with you.

Mr. RIEHLMAN. You do not have a technical staff that is passing information on to you other than those that are on lower levels?

Dr. BENNETT. That is right.

Mr. BALWAN. I have no further questions and Mr. Lantaff indicated he has none.

It has been suggested that you consider inserting in the record the doctor's prepared statement.

Mr. RIEHLMAN. Yes, and the answers to many of the questions we have passed on to him.

Mr. LANTAFF. I have one more question.

Mr. RIEHLMAN. Yes.

Mr. LANTAFF. Would the technical staff under you ever report directly to Admiral Schindler?

Dr. BENNETT. I would try not to take issue with the commanding officer who asked any technical man in the organization any question he wanted to. On the other hand, if he began giving orders to the technical staff without getting me in on the transaction, then I would feel that my control was slipping, and if that slips then I can't take responsibility.

Mr. LANTAFF. That has never happened?

Dr. BENNETT. We have never had any difficulty of that sort. We have always succeeded in working as a partnership with every commanding officer we have had.

Mr. LANTAFF. You are certainly to be commended for that philosophy and approach to it.

Dr. BENNETT. This is a great problem to this country—a chance to make a real contribution in the successful operation of one of these laboratories.

Mr. LANTAFF. I think we ought to engage you as a lecturer to go around to these laboratories.

Dr. BENNETT. Off the record.

(Discussion off the record.)

Mr. LANTAFF. I do not know whether some of this would be classified or not, but could you list some of the scientific achievements of your laboratory and then if you do decide that it is classified we could omit that?

Dr. BENNETT. I think I could tell you some of the things we have done, but before it is published I would like to see it.

Mr. RIEHLMAN. It has been the committee's system that every witness is given a chance to read his testimony before the committee. If you find that something is of a secretive nature, you mark that, and, should the committee decide at a later date to make the hearings public, it will be kept from the public document.

Dr. BENNETT. Well, let me tell you some of the things we have accomplished.

Within the last 2 or 3 years we have evolved a system for focusing our research effort on the key technical problems of the Navy, which

has given us guidance I think rather better than other laboratories have had, in what to do in all the broad area of scientific research; what to do that will provide perhaps the means of solving some of the key technical problems of the Navy.

This is a philosophical approach. We have made a number of feasibility studies of new weapons, including atomic weapons, and on the basis of these studies there are new weapons being built at the present time. We have pushed forward——

Mr. LANTAFF. New atomic weapons?

Dr. BENNETT. New atomic weapons being built.

We have pushed forward our knowledge of very high speed flow in our aeroballistic facility where we can produce flows of air up to Mach No. 10, because the problem of our ballisticians is to provide the projectile that will catch the supersonic airplane. With the airplanes now flying faster than sound the projectile or missile must fly many times faster than sound.

We also have the means of shooting models in air at atomospheric or higher pressure to check these wind tunnel measurements and make sure that our calculations are right. This is a very important area of our operation.

We have almost doubled the effectiveness of military chemical explosives in the last 7 years as a result of the work of our explosive research group.

We have been present at almost all the atomic explosions with one of our scientific groups, devising and developing means for measuring the blast and the ground shock from these explosions as a direct means of estimating the effect of the bomb.

We took the proximity projectile fuse at the end of the war and provided the design disclosures which made it possible in the Korean war to put a dozen new contractors into the business of manufacturing these complex and difficult devices with hardly a ripple of difficulty. Instead of being a scientific curiosity that required careful nurturing on the part of a lot of scientists, it became a manufacturable product.

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We have produced a whole new line of magnetic materials of which bismanol is an important one. This is a permanent magnet material which uses neither nickel nor cobalt, which we know will be almost unobtainable in wartime. Bismuth and manganese are relatively available. An outgrowth of this magnetic materials effort was thermenol, which is an aluminum iron molybdenum alloy, which apparently will substitute for stainless steel and use no nickel. It will be lighter and cheaper and in some things it will be better. It will be useful as a substitute for nichrome, which again involves nickel, for resistance heating elements, for furnaces and toasters and things of that sort.

We have produced orthonol, which is a magnetic material with a rectangular hysteresis loop—this is a magnetic material which greatly expands the usefulness of magnetic amplifiers, and the magnetic amplifier is a very important thing to the Navy because it involves only wires and iron cores, and surface rectifiers, and gets away from the vacuum tube, which causes so much difficulty under sea and battle conditions. This is an important objective.

We have several other magnetic materials. We have done a number of things in the application of plastics in ordnance. The one that comes to mind is the development of a fiberglass plastic tube which occupies no more volume than the aluminum rocket tube for the same purpose, and is a lot lighter in structure.

Mr. LANTAFF. Doctor, if there is anything further you want to add to that when you go over your testimony, as the chairman indicated, you can do so.

Dr. BENNETT. I am sure some of this is classified.

Mr. RIEHLMAN. Probably.

Mr. LANTAFF. You can indicate what the classified part is.

There is only one final question I have. In connection with these developments you have mentioned some proposals that we know the Air Force, the Atomic Energy Commission, the Chemical Warfare Section of the Department of the Army and the Army Chemical Corps are interested in. What liaison do you maintain with comparable research projects or laboratory work within other services?

Dr. BENNETT. This liaison appears in a very wide variety of ways. In the things that are in early stages—in research or early applied research—the best liaison is the interchange resulting from the visits of people to each other's laboratories, or the attendance at professional society meetings where they can talk these things over, especially the symposiums organized by the Department of Defense—and there are a great many of these. We get into our library, I think it is about 10,000 individual documents a year, which are sorted and classified and made available to our staff. There is a great deal of liaison through the Bureau of Ordnance between our station and other Navy stations.

There are joint Army-Navy-Air Force committees, like those on electronics and vacuum tubes. The word gets around in many ways. Then of course, Mr. Quarles' office and before him the Research and Development Board, have used various means of coordinating this effort.

Mr. LANTAFF. There must be a certain amount of duplication of effort or overlap of scientific work, is there not?

Dr. BENNETT. This is undoubtedly true. The important thing is to know where the overlap is, and decide whether it is intelligent to follow two approaches to the same problem, or whether it isn't. If the people who are involved get together and discuss their approaches, this in my opinion is the best way of making reasonably sure that this overlap is desirable, or, if it is not, it will get dropped.

Mr. LANTAFF. Do you have any Army and Air Force scientists or representatives attached to your laboratory?

Dr. BENNETT. We have from time to time. We have an Air Force officer, or we did have one full-time, and we have one part-time now.

Mr. LANTAFF. Not on a permanent basis, though?

Dr. BENNETT. No. One of his duties is to come out to Naval Ordnance Laboratory about once a week and see what is going on, in the areas of interest to the Air Force. We have worked very closely with the Ballistics Research Laboratory at Aberdeen on atomic-bomb tests; and the exchange of information in areas where the people know each other and know they are working on similar problems, takes care of itself. If they know the story and have the means of getting it back and forth, they do.

Mr. LANTAFF. You think there is adequate liaison on the part of the other services with you as to technological advances they are making?

Dr. BENNETT. I think it is reasonably good. I don't feel we are wasting very much on duplication. I think for instance that the man who is working in projectiles in our laboratory is very familiar with the things the Army is doing and the people who are doing it. They exchange visits back and forth. This will automatically consolidate efforts, and nobody willingly follows the trail of somebody else in a scientific inquiry.

Mr. LANTAFF. That is all I have, Mr. Chairman.

Mr. RIEHLMAN. Are you now at all actively engaged in the development of guided missiles?

Dr. BENNETT. We have no guided missile as such. Because of our experience and background and facilities for explosives we are working on warheads, and until recently we were working on fuses, but no complete missiles.

Mr. RIEHLMAN. No complete missiles?

Dr. BENNETT. That is right.

Mr. BALWAN. Does the Bureau of Ordnance outside of Naval Ordnance Laboratory work on guided missiles?

Dr. BENNETT. Yes. They have several laboratories engaged primarily in guided missiles.

Mr. BALWAN. Could you tell us where those are, or what type?

Dr. BENNETT. The Naval Ordnance Testing Station does a lot in this direction. The Applied Physics Laboratory at Silver Spring, which is quite different, being a contract operation, is entirely engaged in—or almost entirely—in guided missiles.

The Bureau of Aeronautics is doing work in guided missiles largely with contractors but this all comes together at Point Mugu, the Naval Air Missile Testing Center at California where they test prototypes.

Mr. BALWAN. But your missiles are tested within your field?

Dr. BENNETT. We as a laboratory are not developing any guided missiles.

Mr. BALWAN. I mean, the Bureau of Aeronautics guided missiles are tested at Inyokern.

Dr. BENNETT. I think some at Inyokern and at Mugu, and some are tested at White Sands. There seems to be a pretty good interchange of use of facilities in this area.

Mr. RIEHLMAN. Are there any other questions?

Mr. LANTAFF. I have no other questions.

Mr. RIEHLMAN. Doctor, we want to express to you our very deep appreciation for your coming here this afternoon and giving us this very helpful information. I want to reiterate what I said before. You will be furnished with a copy of the transcript, which you will be permitted to make any corrections on that you would like to. If you will mark the portions particularly in respect to your last remarks here, which you feel are of a secretive nature and would not care to have them in public hearings, if they are made public, we will see that that is taken care of.

We will insert in the record your statement and the answers to the questions presented.

(The proposed statement of Dr. Bennett is as follows:)

STATEMENT OF RALPH D. BENNETT, TECHNICAL DIRECTOR, NAVAL ORDNANCE LABORATORY, WHITE OAK, MD.

It should be borne in mind that the big military laboratories are a recent development growing out of the close association between science and warfare which was shown to be necessary by the developments of World War II. The assembling of the technical staffs for these great laboratories, and their organization into effective units, is the sort of thing that requires a generation of time to evolve, whereas, less than 10 years has elapsed since the end of the war which demonstrated their need. Therefore, a certain amount of difficulty can be expected in the evolution of these organizations, and looking back over the last 10 years shows that, despite these difficulties, great strides have been made in the evolution of useful and productive establishments.

The Naval Ordnance Laboratory grew from a staff of about 50 people in 1940 to nearly 2,000 in 1945. Under the patriotic incentive of World War II it was possible to gather a rather better than average technical staff. At the end of the war, the management of the laboratory cast about for a scheme of operation which would insure that a reasonable fraction of this superior staff would be retained to carry on the work which the developments of World War II indicated to be a continuing necessity. As a result of this effort, a document known as the Operating Principles was evolved. These principles (copy attached) have been reaffirmed repeatedly by successive Chiefs of the Bureau of Ordnance and have been elaborated by Admiral Schoeffel in a letter of 22 June 1951 (copy attached). The essence of these principles is that scientific and technical decisions will be made by professionally trained scientists and engineers; military decisions will be made by trained military men, and that the two groups working together can evolve better weapons and material than either or both groups working separately. Our experience over the past decade has confirmed the correctness and workability of these principles.

With respect to the "Reported problems in military research and development programs" compiled by the subcommittee staff, the following statements can be made insofar as Naval Ordnance Laboratory experience bears on them.

I. Civilian scientists in military research and development centers are reported to be generally dissatisfied with military domination and administration.

This is not a true statement with respect to the Naval Ordnance Laboratory. Under every commanding officer so far sent to the laboratory, the civilian scientists and the officers have worked together with all the harmony that could be expected between able men interested in the common objective but obviously differing from time to time in opinions. We do not believe that the level of discontent has been any higher than would be found between groups in a well-run industrial laboratory.

II. Civilian scientists are leaving military R. & D. centers in a general exodus.

The general turnover at the Naval Ordnance Laboratory during the calendar year 1953 was 13.3 percent; the turnover of civilian technical staff was 13.7 percent. Many of those from the technical staff who leave go to naval or governmental laboratories or into industrial establishments doing the same kind of work. We feel that a reasonable turnover of this sort is good for all concerned. The motive for leaving is more often the attraction of a much higher salary than dissatisfaction with the administration and operation of the laboratory, and little or none is due to military-civilian relationships.

III. When a military organization is imposed on a research and development program there is a tendency for the military to expand its control over technical decisions and operations in the research laboratories.

This does not apply to the Naval Ordnance Laboratory. There is sometimes a tendency to take an inappropriately broad view with respect to the kind of a program which these laboratories should carry on. At the Naval Ordnance Laboratory we have always realized that our primary objective is to provide the best possible weapons for the Navy, and that what we do must therefore be very strongly influenced by what the Navy feels it needs and can use, and to this extent it is appropriate that the program should be controlled by naval officers. We have not found it difficult to get support for the development of new weapons originated by the scientific staff, at least to the extent where their feasibility can be tested.

IV. Military research and development officers are not scientists who command the respect of the civilian scientists.

The research and development officers sent to the Naval Ordnance Laboratory are primarily seagoing officers whose main objective is to insure the maximum

effective use of the fleet. They do not claim to be scientists, nor should they be judged as scientists. The Naval Ordnance Laboratory has been especially fortunate in having assigned to it probably more than its share of extremely able officers, whose abilities and capacities are, in my opinion, second to no other group in the Nation.

V. The policy of rotating assignments for military officers militates against the retention of officers who in some cases have the training, talents, and disposition to guide scientific research centers.

This statement must be considered in the light of the fact that the military men who are sent to the Naval Ordnance Laboratory are being trained primarily to operate the fleet. It would be contrary to this primary objective to retain them beyond the normal rotation periods merely because they happened to have an unusual aptitude for the work of the laboratory. The civilian technical staff has the responsibility of carrying the continuity of programs, procedures, and developments through officer turnover.

VI. Research centers often are organized and administered as military organizations with the attendant restrictive forms, procedures, regulations, and military discipline which do not provide the optimum climate for research work by civilian scientists.

This is not applicable to the Naval Ordnance Laboratory. The requirements of security, care in the handling of public funds, and the following of established procedures in dealing with contractors, impose a formidable array of restrictions on the operation of a military laboratory. However, these restrictions are the outgrowth of long experience, and we have found that the administrative officers responsible have more often than not been quick to recognize the special requirements of research and development and that over the past 10 years the regulations involved have been changed very considerably and, in fact, as extensively as could be expected to meet the special requirements of our laboratory. This is not to say the improvements cannot still be made, but the process is evolutionary and requires time.

VII. The lack of either a definite or consistent policy for organizing and administering research and development centers leaves each center at the mercy of each change in commanding officers and executives. This creates an instability with no assurance that even the well-run research and development center will not become, with a change of officers, an unbearable situation.

This problem again must be viewed in relation to the youth of these laboratories as large enterprises. Progress has been made in the evolution of policies for organizing and administering these centers and is admittedly not yet perfect. However, further progress can be expected and it will be best achieved by the officers and scientists working together. It is inevitable that the smooth operation of one of these establishments will depend importantly on the cooperation of the scientists and the naval officers and that personality difficulties can be expected to be detrimental to their smooth operation. This is, perhaps, more critical in an organization such as that at NOL than it would be in an industrial laboratory where there would not be two separate groups so clearly defined. However, the difficulties we have experienced from this problem have, in my opinion, been minor and our operations have been far smoother than certain industrial establishments of which I know. It is likely that continued support of the Operating Principles by each Bureau chief will provide a continuing policy within which harmonious relations can be maintained by reasonable military and technical personnel.

VIII. Several outstanding civilian scientists who have been associated with military research and development programs are reported to be in favor of changes in the governmental organization and administration of these programs.

This is undoubtedly true, and it is to be expected that in this, as in any other human endeavor, ways of improvement can always be found. Improvement is and will be a continuing endeavor, but it can more profitably be evolutionary than revolutionary. Probably those who have remained with the programs will be more effective in bringing about these changes than those who have left.

IX. The funding of research and development is confused when handled with military budgets. Direct research and development costs are justified to and appropriated by the Congress as such. However, this does not give a true picture of the actual total cost of military research and development programs inasmuch as there are substantial indirect costs arising from military support functions in the form of pay for uniformed officers, provision of capital facilities, and certain maintenance and operation expenditures.

In this connection, it is reported that it is often felt necessary to build up a research and development center with such support functions in order to make it "respectable" in terms of size and complexity as a command for a colonel or general. This, in turn, sets off a vicious cycle in that the existence of military support elements becomes a further excuse for military domination, more officers, regulations, etc.

The funding of research and development is, by its nature, extremely complex. A good part of the difficulty comes from the fact that the evolution of a new weapon usually starts on a very small and inexpensive scale and, as its feasibility is proved, as experimental models are built, as pilot production is undertaken, the cost of each step skyrockets until, when a new and complex weapon is ready for production, the total effort and cost are astronomical. Any attempt to decide just how much of these costs should be charged to research and development is bound to be difficult. It is probable that a system will be evolved for evaluating the various costs in such a way as to satisfy all concerned reasonably well, but it will take time to accomplish this.

In our laboratory the costs arising from military support functions in the form of pay for uniformed officers is a small fraction (less than 1 percent) of the total, but it can be estimated fairly accurately if the need should arise. We have accurate figures on the costs of capital facilities and on maintenance and operating expenditures. We know, for instance, that over the past 5 years our costs have been $18,500 per year, plus or minus $500, per trained technical man, and these compare favorably with industrial costs for the same kind of work.

It has been our experience that the key to economical operation of a laboratory is embodied in paragraph 12 of our Operating Principles, which says that our service organizations exist to serve the technical staff, and in paragraph 10 which makes the military and civilian directors jointly responsible for economical and efficient operation of the establishment. In a very real sense, the size of our public works organization, our supply department, our technical shops, our drafting room, our security services, have been dictated by the needs of the technical program as interpreted by the technical staff. We have repeatedly examined our overhead costs in the form of services of the type discussed in problem No. 9, and have, in my opinion, been extremely successful in keeping them at a minimum consistent with effective operation. In this we have had the stanch support of the responsible naval officers in the laboratory. I feel that the last part of problem No. 9 has no important bearing with respect to the operation of the Naval Ordnance Laboratory.

UNITED STATES NAVAL ORDNANCE LABORATORY

WHITE OAK

SILVER SPRING 19, MD.

Subject: Operating principles, Naval Ordnance Laboratory.

1. The Naval Ordnance Laboratory is a primary research and development activity of the Bureau of Ordnance, responsible to that Bureau for its funds, its operations, and its results.

2. The mission of the Naval Ordnance Laboratory, briefly, is to originate and analyze new ideas in ordnance, and to advance them by research, development, test and evaluation, under the direction of the Bureau of Ordnance.

3. It is essential that there be a positive, integrated program which the laboratory has a share in planning.

4. To accomplish results, adequate facilities and funds and superior professional personnel are mandatory.

5. Superior military and civilian professional personnel are alike essential, each with adequate authority and responsibility, each supplementing the other.

6. It is the responsibility of the professional civilian staff to produce technical accomplishments in research, development, design, test, and supporting activities.

7. It is the primary responsibility of the technical armed services officers attached to the laboratory to assist and advise the civilian technical staff on matters relating to the development of ordnance material designed to meet service requirements and operating conditions.

8. The commander is responsible to the Chief of the Bureau of Ordnance for all phases of operation of the laboratory.

9. The technical director, a civilian, is responsible to the commander for all the technical work of the laboratory.

10. The commander and the technical director are jointly responsible for the effective and economical internal functioning of the laboratory.

11. The civilian heads of all technical activities are responsible to the technical director through the appropriate line organization.

12. The primary function of the service departments is to aid in supplying the needs of the technical staff for accomplishing the work specified by the technical director.

13. The Naval Ordnance Laboratory is an integral part of the Naval Establishment. Its staff members, military and civilian, are equally a part of that establishment. Every effort will be made to provide opportunities for professional advancement and recognition, to the end that all hands will be proud that they are a part of the Navy.

Revised, December 12, 1951.

W. G. SCHINDLER,
Rear Admiral USN,
Commander, NOL.

Approved, December 28, 1951.

M. F. SCHOEFFEL,
Rear Admiral, USN,
Chief, Bureau of Ordnance.

DEPARTMENT OF THE NAVY

BUREAU OF ORDNANCE

WASHINGTON 25, D. C., *June 22, 1951.*

BUORD ORDER NO. 28–51

Subject: Status of Naval Ordnance Test Station, Inyokern, and Naval Ordnance Laboratory, White Oak.

1. *Purpose.*—It has come to my attention that many of the present personnel of the Bureau are unfamiliar with the Bureau's basic policy in regard to the Naval Ordnance Test Station and the Naval Ordnance Laboratory.

2. *Background.*—At these two stations the Bureau has since 1946 been engaged in an experiment in the method of operating large-scale military laboratories. At that time the Bureau decided to operate these two installations on the principle that the technical activities would be conducted and directed by professional civilian scientific and engineering personnel, and that the role of the military personnel would be that of providing the necessary knowledge of operating conditions plus the administration required to make the laboratory a part of the Naval Establishment in the broadest sense. With this in mind these laboratories have consistently been staffed with professional civil-service personnel of the highest quality obtainable, under the leadership of a technical director in whose hands the responsibility for the technical achievements of the laboratory is placed.

3. Each of these laboratories was provided with an official document known as the Principles of Operation and informally as the charter.

4. That of Inyokern contains the following statement. "It is the intention that this station and its facilities will be so organized and operated as to insure the successful conduct of its research, development, and test program with the effectiveness fully equivalent to that attained during the war by OSRD groups working in the corresponding fields. In order to accomplish the stated mission it is necessary to attract and hold a technical staff of the highest caliber. To attract and hold such individuals it is necessary to provide a working environment and encouragement of outside contacts comparable to those found in major academic and industrial research and development centers. The technical director of the research and development program shall be delegated control of the research, development, and training activities, including methods of conducting research. The technical director will propose distribution of personnel and facilities assigned to the station and conduct projects in accordance with the priority set up by directives from the Bureau of Ordnance."

5. The charter of the Naval Ordnance Laboratory contains the following statements. "The Naval Ordnance Laboratory is a primary research and development activity of the Bureau of Ordnance, responsible to that Bureau for its funds, its operations, and its results. The mission of the Naval Ordnance Laboratory, briefly, is to produce ideas for naval ordnance, and to apply them with maximum

efficiency to the needs of the Navy. It is essential that there be a positive, integrated program which the laboratory has a share in planning. To accomplish results, adequate facilities and funds, and superior professional personnel are mandatory. Superior military and civilian professional personnel are alike essential, each with adequate authority and responsibility, each supplementing the other. It is the responsibility of the professional civilian staff to produce technical accomplishments in research, development, design, test, and supporting activities. It is the primary responsibility of the professional officers attached to keep the civilian technical staff advised of fleet requirements and operating conditions. The commanding officer is responsible to the Chief of the Bureau of Ordnance for all phases of operation of the laboratory. The technical director, a civilian, is responsible to the commanding officer for all the technical work of the laboratory. The civilian heads of technical departments are responsible to the technical director for all activities in their departments. Technical officers as assigned will report to heads of the technical departments and work under their direction. The administrative officer, normally the second in military command is executive officer for military personnel. He serves also as deputy to the commanding officer, and his primary duty is to serve the needs of the civilian staff. The Naval Ordnance Laboratory is an integral part of the Naval Establishment. Its staff members, military and civilian, are equally part of that establishment. Every effort will be made to provide opportunities for professional advancement and recognition to the end that all hands will be proud that they are a part of the Navy."

6. *General.*—The experiment in organization conducted at these two laboratories for the past 5 years has not been without its difficulties. I am convinced, however, that, for a first class research and development activity, it is a form of organization superior to that encountered elsewhere in the Military Establishment. This superiority is beginning to be recognized in other branches of the services and the organization of these two laboratories is beginning to be used as a model elsewhere.

7. It is evident that the premises upon which the Bureau based its decision to form these organizations are sound and, since they now constitute Bureau policy, must have the wholehearted support of the Ordnance Shore Establishment. I enjoin upon all personnel of the Bureau who may have dealings with these laboratories to bear in mind the somewhat unusual nature of their organizations and to conduct the business of the Bureau with them accordingly.

8. *Orders, memoranda, etc., canceled or superseded.*—None.

9. *Effective date.*—On issue.

M. F. SCHOEFFEL.

DISTRIBUTION:
A, B
Division and Program Directors
Branch and Section Heads
In, Le

THE REWARDS OF RESEARCH

This is Naval Ordnance Laboratory's research and development record for over three decades. The developments are rated (with rough approximation) from 1 to 10 on the basis of operational importance and technical significance. In general terms, a "10 strike" should be a development of which the success (or lack of success) significantly alters modes of warfare.

For more than one-quarter of the developments, Naval Ordnance Laboratory cannot claim full originality, particularly in later years when the Laboratory has associated itself with industry during the transition from development to production, but in each case the Labora.ory has made a substantial technical contribution of its own.

The difficulty of assigning a precise date to developments which extend over several years is resolved by choosing the year in which it became generally agreed that success was assured. Only major initial developments are included; later modifications, improvements, or repackagings are omitted.

Such a presentation suffers from a great deal of subjectivity in all its parts—the selection of items, the assignment of dates, and the choice of values are all somewhat of a matter of opinion. Such a listing is not, of course, a static thing. Changes in operational requirements may easily make a development which is now obscure become a very important one, or reduce a current favorite.

This list was prepared by studying old records, progress reports, histories, and memorandums, as well as by discussions with many individuals. This selection was made from notes which list several hundred identifiable items.

Accomplishment	Year	Rating	
		1–5	6–10
Moored antenna mine	1918	X X X X X	X X X
Gunfire spotter shell and fuze	1925	X	
Antiaircraft fuze	1928	X	
Delay fuze for AP projectiles	1930	X X X X	
Drifting contact mine	1931	X X X X	
Aircraft bomb fuze	1932	X X X	
Submarine-laid contact mine	1935	X X X X X	
Degaussing and demagnetization of ships	1940	X X X X X	X X X
Measurement of influence fields of ships	1941	X X X X X	X
Submarine-laid bottom mine	1941	X X X X	
Acoustic torpedo range	1941	X X X	
Mechanical fuzes for antiaircraft projectiles	1942	X X X X X	X X X X
Operational research (in United States)	1942	X X X X X	X X
Aircraft-laid bottom mine	1942	X X X X X	X
Magnetic induction mine-firing device	1942	X X X X X	X
Mechanical base fuzes for projectiles	1942	X X X X	
Mine and bomb disposal gear	1942	X X	
Mechanical fuzes for barrage rockets	1943	X X X X	
Fast-sinking depth charges	1943	X X X X	
Magnetic airborne detector	1943	X X X X	
Tracer compositions	1943	X X X	
Towed streamer antitorpedo device	1943	X X X	
Ordnance locators	1943	X X X	
Audio-frequency acoustic mine-firing device	1943	X X X	
Shore-controlled magnetic mine-firing device	1943	X X	
Radio-controlled demolition boats	1943	X X	
Harbor defense detectors	1943	X	
Pressure mine-firing device	1944	X X X X X	X X X X X
Acoustic depth charge pistol	1944	X X X X X	X
Environmental simulation equipment	1944	X X X X X	
Low-frequency acoustic mine firing device	1944	X X X X	
Antisubmarine bomb nose fuze	1944	X X	
Oscillating contact mine	1944	X X	
Acoustic vibrator anti-railroad mine	1944	X X	
Moored obstructor mine	1944	X	
Graduated explosive acoustic minesweep	1945	X X X X	
Magnetic influence torpedo exploder	1945	X X X X	
Locators and destructors for amphibious demolition	1945	X X X X	
Moored magnetic mine	1945	X X X	
Fabric sweep for pressure mine	1945	X X X	
Self-propelled bottom mine	1945	X X X	
Long-delay bomb tail fuze	1945	X X	
Plastic strippable film	1945	X X	
Water siren acoustic minesweep	1945	X	
"Crossroads" measurements	1946	X X X X	
Geophysical applications of MAD	1946	X X	
Design, construction, and move to White Oak	1947	X X X X	
Magnetic fuze for ahead thrown A/S weapon	1948	X X X X X	X
Orthonol	1948	X X X X X	
Underwater sound signal bomb	1948	X	
Air blast measurements for AEC	1949	X X X X	
High-altitude bottom mine	1949	X X X X	
Gasless delay powders	1949	X X X X	
Electromagnetic torpedo exploder	1949	X X X	
Very long range detection of explosions	1949	X	
Design disclosures for proximity fuzes for guns	1950	X X X X X	X X X
Internal combustion torpedo engine	1950	X X X X	
Very low energy detonators	1950	X X X	
Parabanol	1950	X X	
Vector airborne magnetometer	1950	X X	
Prototype of ordnance support weapon	1950	X X	
Controlled fragmentation g/m warheads	1950	X	
Fuzing for TX–8	1951	X X X X X	X X
Hypersonic flow without condensation	1951	X X X X X	
Moisture-resistant explosive train components	1951	X X X X	
Fluoroscopic inspection of rocket propellants	1951	X X X X	
Magnetic amplifier with single-cycle response	1951	X X X X	
Sensitive submarine-laid bottom mine	1951	X X X	
Major caliber illuminating projectiles	1951	X	
Process for lead selenide infrared detectors	1951	X	
All-weather proximity fuze for guns	1952	X X X X X	X
Bismanol	1952	X X X X X	
Shallow water acoustic mine	1952	X X X X	
Drill kits for mines	1952	X X X X	
Ground shock measurements for AEC	1952	X X X X	
HBX–3 for underwater ordnance	1952	X X X X	
Supersensitive degaussing ranges	1952	X X X	

Accomplishment	Year	Rating	
		1-5	6-10
Tracking system for A/S torpedoes	1952	X X	
Fuzing for drone aircraft	1952	X X	
Bore safe fuzing for small-caliber guns	1952	X X	
Explosive train designers' handbook	1952	X	
Antisubmarine aircraft-laid bottom mines	1953	X X X X X	X X
Fuzing and safing of TX-11	1953	X X X X X	
16—Alfenol	1953	X X X X X	
Universal contact exploder for homing torpedoes	1953	X X X X	
High-speed, high-altitude flight gear for stockpile mines	1953	X X X X	
Antisneak craft controlled mine system	1953	X X X	
Aircraft-laid obstructor mine	1953	X X X	
Antijunk research and mine development	1953	X X X	
Proximity fuzes for automatic guns	1953	X X X	
Exploder for interim mine destruction system	1953	X X	
Degaussing design of new-type submarines	1953	X X	
Magnetic decision elements for digital computors	1953	X X	
Command-steered projectile from rifled barrel	1953	X	
Active acoustic torpedo exploder	1953	X	

Mr. RIEHLMAN. The committee stands adjourned.

(Whereupon, at 4:35 p. m., the hearing was adjourned until 10 a. m., the following day, Wednesday, June 23, 1954).

ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

WEDNESDAY, JUNE 23, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON MILITARY OPERATIONS OF THE
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met at 2 p. m., in room G–53 in the Capitol, the Honorable R. Walter Riehlman (chairman of the subcommittee) presiding.

Mr. RIEHLMAN. The committee will come to order.

Have the record show the members who are present and that Mr. McCormack is detained because of an important meeting at the White House. Mr. Lantaff and Mr. Ikard are expected momentarily.

With your permission as another member of the subcommittee, we will call the subcommittee to order.

I want the record to show that Mr. Lipscomb and the chairman are present. We anticipate Congressman McCormack and Mr. Ikard and Mr. Lantaff will be present momentarily.

This afternoon, we are honored by having Maj. Gen. J. F. Uncles who is Chief of Research and Development in the Office of the Deputy Chief of Staff for Plans and Research in the Department of the Army.

General, members of our staff have discussed with you prior to today's meeting our interest in this field of research and development. And I understand that you have a prepared statement that you probably would like to follow along with the presentation of some charts to the committee outlining your activities and the program that is followed in your Department.

General UNCLES. That is correct, sir.

Mr. RIEHLMAN. Then if that is understood, we will proceed. If you want to read into the record your statement—is that what you have in mind?—or would you rather speak from the statement extemporaneously?

General UNCLES. I believe I would rather speak from the statement. However, my remarks will follow.

Mr. RIEHLMAN. That is very good.

General UNCLES. Does each member of the committee have the charts?

Mr. RIEHLMAN. Do you have the charts, Mr. Balwan?

Mr. BALWAN. We were not provided the charts, as I understand this. We understood that you had a large chart that you were going to put on from an easel.

Colonel BETTS. We sent copies of these others. Apparently, because they were secret they were hidden in your safe somewhere. I have some extra copies here. There is no use chasing them down.

NOTE.—Asterisks denote classified material deleted.

General UNCLES. Will you provide them?

Mr. RIEHLMAN. It is just necessary that Mr. Lipscomb and the staff member here and myself be provided. That is all that is necessary at this time.

Colonel BETTS. I have several copies here.

Mr. RIEHLMAN. Thank you very much.

STATEMENT OF MAJ. GEN. J. F. UNCLES, CHIEF OF RESEARCH AND DEVELOPMENT, DEPARTMENT OF THE ARMY; ACCOMPANIED BY COL. A. W. BETTS, DEPUTY

General UNCLES. In order to be prepared to give adequate replies to questions that may occur to members of the committee during this discussion, I have brought with me my executive, Col. A. W. Betts; my deputy, the chief scientist of the Army, Dr. John E. Vance; and the chief scientist of the Office of the Chief of Ordnance, Dr. R. B. Power, Jr.

I should like to address my first remarks to the questions raised in your letter of June 1.

Mr. RIEHLMAN. Fine.

General UNCLES. The first point for discussion is the scope of the Army's research and development program which has in general terms the mission of developing equipment and techniques to increase the effectiveness of the United States soldier.

In order to accomplish this, we have divided the Army program into major categories as indicated on the charts which have been furnished you. Most of the categories which are shown on the chart No. 1, such as air defense, airborne landing, amphibious operation, supply, and maintenance and materiel and so on, are self-explanatory, but I feel it is appropriate to discuss the nature of the effort that falls under each of the categories.

Under air defense which is specifically shown on chart 3, the effort is largely a matter of weapon development. This chart analyzes the distribution of funds in this operational category. You will note that antiaircraft weapons, both gun types and surface air-guided missiles with the detection and fire-control systems to make them effective, account for over 90 percent of the program in air defense, with the remaining effort largely devoted to achievement of a countermeasures capability.

The next chart, 4, covers the landing, amphibious, and supply and maintenance and materiel.

First, airborne landing. The Army effort to achieve air transportability does not appear from this particular chart to demand a large portion of our funds, but that is because under airborne landing we fund only projects which are directed primarily to the solution of airborne problems such as parachutes, or drop equipment. Our overall effort to achieve air transportability, which is reflected in our program to lighten our equipment generally, trucks, vehicles, tanks, and so on, does not appear in the airborne landing category.

Mr. RIEHLMAN. Mr. McCormack, the general has just started explaining these different charts, and the manner in which their funds are expended.

General UNCLES. We are now on the fourth chart from the top, Mr. McCormack.

The subdivision, amphibious operations, on this chart accounts for a small Army effort in the development of amphibious capability principally the DUKW which is more like the truck than it is a boat. The major part of the program to achieve amphibious capability is carried in the Navy program by interservice agreement.

Under supply and maintenance, on this chart, we fund for a broad program to keep abreast of industrial developments. For example, if a new item of construction equipment is developed by industry, we would fund in this category for the personnel and the testing facilities required to test it. We do not develop new items of equipment of that type.

On chart 5, the next one, you will find a breakdown for atomic, biological, and chemical warfare. I believe that each of these items is self-explanatory. In the biological and chemical warfare effort, the Army, by agreement, accomplishes the bulk of this work for the entire Department of Defense, with some additional funding support from the Navy and Air Force for development of specific end items of equipment required by those services.

Mr. RIEHLMAN. The majority of your funds, as outlined on this chart, are used for that purpose, are they not, for biological warfare, apparently?

General UNCLES. Of the three items there, biological warfare is the largest.

In atomic warfare, the effort is primarily for the achievement of an atomic capability for Army weapons with a small program in medical defensive studies and radiological defense. This chart does not, of of course, show the development of nuclear components of the weapons since they are the responsibility of the Atomic Energy Commission.

The next chart shows the breakdown of funds between personnel operations, intelligence and planning, and psychological warfare.

Under personnel operations, we find for research in human relationships which seeks to find means of making more effective utilization of our manpower.

We also fund for the major part of the Surgeon General's program in military medicine and the Quartermaster General's program in the development of food and clothing.

Under intelligence we fund for the development of equipment for use by intelligence forces and we include herein the Engineering Corps program in mapping and surveying.

The Army Operations Research Office is also funded in this category.

The last breakdown, that of psychological and unconventional warfare I believe is self-explanatory.

Mr. BALWAN. That comes in your division?

General UNCLES. We fund for the research in psychological and unconventional warfare for the Army effort.

Mr. BALWAN. The psychological warfare is part of a special staff; is that right?

General UNCLES. That is correct. There is a Chief of Psychological Warfare in the Department of the Army.

Mr. RIEHLMAN. Your phase is just in research; is that right?

General UNCLES. Sir? This is just in research. He establishes requirements for certain items of equipment. We develop them for him.

The next chart on land combat operations covers the largest dollar segment of the Army program.

I believe the breakdown in subcategories in this program is self-explanatory as far as indicating the scope of the Army research and development effort in this filed.

I will be glad to answer any questions you may have.

Combat vehicles includes tanks, of course.

Mr. BALWAN. What is this item, Army aviation?

General UNCLES. That is the development program for the aviation employed by the Army: helicopters, for instance, or the liaison and command type fixed-wing aircraft which the Army has as part of its equipment.

Mr. BALWAN. This may not be out of place to ask, "Does the Air Force do anything of this type of research and development?"

General UNCLES. The Air Force does it all for us. We place the requirement on the Air Force and they do the development for us. We provide them the funds.

Mr. RIEHLMAN. The chart shows the funds that are allocated for these different specific items?

Mr. BALWAN. The same thing is true for guided-missiles research, then; is that right?

General UNCLES. That is not true for guided-missiles research. We do our own research and development for guided missiles which are being developed for use by the Army.

Mr. RIEHLMAN. Are there any other questions on that chart from any of the members?

Did you have one, Mr. Lipscomb?

Mr. LIPSCOMB. Mr. Chairman, is it all right to get into the funding at this time, to ask questions about the fund?

Mr. RIEHLMAN. Certainly.

Mr. LIPSCOMB. I noticed on a couple of charts that the funds for the full year 1955 have decreased considerably. Is that per your request or——

General UNCLES. I should like to say that the bars which indicate funding on those charts that have been furnished you are not the latest figures. We had just completed our funding program for fiscal year 1955 in the Army Research and Development Review Board when we received the notice to appear before this committee and we did not have time to correct those figures. I have one chart with corrected figures on it here which I would be glad to——

Mr. LIPSCOMB. The funding for the guided-missile program has been increased at this point, has it not?

General UNCLES. The funding for guided-missile program has been increased in fiscal 1955. Under land combat, those are surface-to-surface guided missiles.

Mr. LIPSCOMB. What is the difference between the guided-missile program on the air defense chart and also, and then on the land combat?

General UNCLES. In the air defense side they are surface-to-air guided missiles. In the land defense, land combat chart, they are surface-to-surface guided missiles.

Mr. RIEHLMAN. That is all within your research program. You are working on land to air, and from surface to surface. That is your project that you are into?

General UNCLES. That is correct.

Mr. RIEHLMAN. We would like sometime a little bit later to get into this missions field, but at the present time I do not want to get into it.

Mr. LIPSCOMB. And those figures, those missions are carried on at different locations, in the land combat and the air defense?

General UNCLES. They are carried out by different contractors but both are under the Ordnance Corps. They are tested at the same location, generally speaking. We have one missile which is tested at different locations. Most of them we test at White Sands.

Mr. LIPSCOMB. Then at this point, this chart on the funds is not correct?

General UNCLES. Not on the charts that have been furnished. We will furnish you a corrected chart with the latest funding figures.

Mr. LIPSCOMB. The funding estimates on these charts are what had passed the House of Representatives and not the Senate, is that it? This is not your request?

Colonel BETTS. This is the request to the House of Representatives but at the time the request was made, the funding picture was not the same as it is now. The House cut us $10 million and, at the time we made the charts, we did not know how much money we would have left from fiscal 1954 which would be applied to the fiscal 1955 program. It is a combination of these two things which makes these latest figures that General Uncles mentioned somewhat different from what is shown on the charts.

Actually, these total figures in the category are actual dollars, but the bars represent percentage of funds within a category item by item and by and large the percentages have not varied very markedly.

Mr. LIPSCOMB. Do these lines here indicate the unexpended funds or are these just the amounts appropriated?

Colonel BETTS. In this case they represent our request for new obligation authority to the Congress for fiscal 1955.

They represent the percentage of those funds which then go to each of these subcategories. The funds shown represent the total in the categories.

Mr. LIPSCOMB. These lines do not show relationship to the amount of money that is going to be expended in the full year of 1955 or 1954, or the size of the program?

Colonel BETTS. They are very similar but there have been some minor changes which affect the percentages slightly.

We can indicate this to you with our corrected copies to show you what these changes are. We will give you a final corrected copy once we can do the drafting that is involved.

Mr. LIPSCOMB. Thank you.

Mr. RIEHLMAN. Any other questions?

Mr. BALWAN. I was going to follow up Mr. Lipscomb's question. Has the expenditure for research and development been reduced for 1955 from that of the previous years? Is your request lower than what you spent last year?

General UNCLES. The sum appropriated by the Congress last year was, for the Army research and development, $345 million.

Mr. BALWAN. For the total research and development program?

General UNCLES. That is the same sum that the House approved and the Senate Appropriations Committee approved.

Mr. RIEHLMAN. Last year.

General UNCLES. That was passed last year and this year it is the same.

Mr. RIEHLMAN. You have requested the same this year?

General UNCLES. We requested for this year——

Mr. BALWAN. That is the point that we were trying to make. I was trying to get at how much you did request and what did the House give you in its bill?

Mr. MCCORMACK. First, what did the budget message—what were the budget estimates? I think there is a request and it goes to the Bureau of the Budget and comes up to the House.

General UNCLES. The budget estimate was $355 million. The House reduced our request by $10 million.

Mr. RIEHLMAN. Gave you $345 million? The budget gave you exactly what you asked for?

Colonel BETTS. That is right.

General UNCLES. That's right.

Mr. LIPSCOMB. Excuse me. Was that reduction made because of the unexpended funds that you had not taken advantage of?

General UNCLES. That was mentioned in the committee report. I believe it said, in view of the carryover the request is reduced by $10 million.

Mr. RIEHLMAN. Do you have any idea what the carryover is?

Colonel BETTS. It is indicated on the first chart, sir. When you look at the total fiscal 1954 fiscal, availability of funds for obligation, you see the figure $378.8 million, whereas actually we had appropriated only $345 million for that fiscal year. The difference represents the estimate of carryover at the time we drew up these charts and it has not changed very markedly.

Mr. RIEHLMAN. About $23 million?

Colonel BETTS. No, sir; it is a little more than that.

Mr. RIEHLMAN. I beg your pardon. Forty-some millions.

Mr. BALWAN. Forty-seven.

Colonel BETTS. It has not changed very much from the estimate at the time these were made.

General UNCLES. About $34 million.

Mr. BALWAN. How is your budget request handled? For instance, does the Ordnance Corps request its own research and development fund, and then can the Chemical Corps request its own and so forth down the line. Does the committee consolidate it somewhere, or does your office determine the total request some way?

Is it all right to take time on this?

General UNCLES. We expected to cover that anyway in connection with our explanation of the organization.

Mr. RIEHLMAN. It would be easier for you to cover it at that point, General? If so, I am sure we have no objection. We will proceed right along when we come to that.

Mr. BALWAN. I had another question. If you are going to answer this one later on, we can ask it then. If your research and development expenditure is in the magnitude of the order of over $300 million, this is primarily direct costs, am I correct?

General UNCLES. I am not sure that I understand, but——

Mr. BALWAN. May I explain it, then, what I mean by the question?

If we have an installation such as Detrick or Aberdeen, a certain amount of work is in contract form for research and development. A lot of other work is done on a military post with military officers and enlisted men doing the work. Are those expenses borne by the research and development funds, or are they considered indirect costs and come out of the pay of the Army?

General UNCLES. The expenses, the utilization of military personnel, comes out of funds other than research and development. We do not——

Mr. BALWAN. Had you planned to answer that question further on in your statement?

General UNCLES. No, sir; I do not believe that was raised.

Mr. BALWAN. The only thing that I would like to do, Mr. Chairman, in point of view of writing a report, in pointing up the magnitude of the total research and development program, it would be inaccurate to state that the Army's expenditure for research and development is over $300 million in that area. It may be, as the Air Force told us, that although their indirect costs were five or six hundred million dollars, that their indirect costs probably were about another billion dollars on top of that.

General UNCLES. The same situation obtains for the Army, although I do not believe ours would run as high as that of the Air Force.

Colonel BETTS. The magnitude of those other costs is included in the statement but we did not try to cost the military personnel, Mr. Balwan. We indicated by enclosures the numbers of military personnel used in the research and development program.

Then, on page 8 of the statement we discussed the money from the maintenance and operation appropriation which is applied to research and development to give you an overall idea.

Mr. BALWAN. Then you are answering the question.

Mr. RIEHLMAN. You will cover it eventually in the statement.

Mr. BALWAN. We had it in one of those questions in our original letter, and I said if you are going to be covering that we will answer it then.

Mr. RIEHLMAN. Is there another question on this present chart? If not, we will proceed to the next one, General, if you have a statement on that which is on materiel, components, and advanced research.

General UNCLES. This last chart on materiel, components, and advanced research covers another sizable portion of the funds devoted to the Army program and can best be described as that part of the program which maintains strong supporting research effort from which will spring ideas that can be built into weapons or equipment in the future. The research in this category is the first step in the development of a new or improved weapon. The breakdown into subcategories on the chart is provided merely to indicate the relative emphasis we place on each of the technical fields.

Mr. RIEHLMAN. All right, any questions on that chart?

General UNCLES. All right, sir; now you have asked the extent of coordination of the technical services program effected at the level of the Chief of Staff and the Secretary of the Army.

I think this question can best be answered in conjunction with your request that I discuss the Army research and development organization illustrating lines of responsibility and authority and to do this, I

have furnished you a chart showing the Army's organization by crosshatching the places within this organization where you will find elements of research and development.

The rectangles that are completely crosshatched indicate elements that are devoted exclusively to research and development. The rectangles that have a small area crosshatched indicate elements that only have a fraction of their work devoted to research and development.

This may appear to be a complicated chart. I would be glad to answer any questions that anyone may have. My office is the Chief of Research and Development block.

Mr. RIEHLMAN. You are directly under the Under Secretary of the Army.

Mr. MCCORMACK. How many civilian scientists are in your office?

General UNCLES. I have Dr. Vance. He is the only one I have in my own office.

Mr. MCCORMACK. What is his position in relation to you?

General UNCLES. He is my deputy.

Mr. MCCORMACK. What are his authorities and power?

General UNCLES. He has the authorities and powers of a deputy, i. e., in my absence, the same powers as I have, insofar as a civilian can perform the functions performed by an Army officer.

Mr. MCCORMACK. I am not referring to the command functions. Suppose you are there; what is his authority?

I realize that is a broad question.

General UNCLES. I would say that he has the same relationship to me that a chief of staff does to a commander in the field. I consult him and of course he looks after certain fields of research, takes them under his wing, so to speak.

Dr. Vance can best answer that.

Dr. VANCE. I think the best answer is that we work as a team. I can do certain things that General Uncles cannot do quite as readily, perhaps, and he can do lots of things that I cannot do as well as he.

Mr. MCCORMACK. How long have you been there?

Dr. VANCE. Nine months now. I have been associated with the program in other ways before that time.

Mr. MCCORMACK. What has been your association before with officers?

Dr. VANCE. I am a reserve officer.

Mr. MCCORMACK. Well, I was not talking to you as an officer; I was talking to you as a scientist.

Dr. VANCE. I am a chemist. I head the chemistry department of New York University.

Mr. MCCORMACK. I was talking to you in your professional capacity. Do you get along with the other officers?

Dr. VANCE. Very well, indeed. I think I may say that.

Mr. MCCORMACK. I do not want you to draw the inference from any questions that I ask that I am adverse because we are just trying to get information.

Are you the top civilian in the field of science?

Dr. VANCE. There are 13 jobs in the Army that have a comparable rating, so-called P–9 rating, which was authorized by special act of Congress; and so far as that rating goes, we are all equivalent.

Mr. MCCORMACK. Of course, after you get through with your bureau, your section, where does it go to?

Dr. VANCE. They come up.

Mr. MCCORMACK. To whom do you go up?

Dr. VANCE. General Lemnitzer, Deputy Chief of Staff for Plans and Research.

Mr. MCCORMACK. Do you go up to the Under Secretary of the Army?

Dr. VANCE. Yes, sir.

Mr. MCCORMACK. In some cases?

Dr. VANCE. Yes. Perhaps I could get at the answer most readily by saying there is not any rigidity of the structure so far as my position as civilian is concerned. I can talk to the Chief of Staff of General Lemnitzer or the Under Secretary or the Secretary, or Assistant Secretary of Defense for Research and Development, any one of them. There is no restriction on that.

Mr. MCCORMACK. I notice here Assistant Chief of Staff, G–4, Logistics; is that a new office?

General UNCLES. Assistant Chief of Staff, G–4, Logistics. That is General Palmer who is the G–4, that is not a new office.

Mr. MCCORMACK. Is that the same as Deputy Chief of Staff for Logistics?

General UNCLES. No, sir; that is not.

This chart was drawn up before the new organization, of course, was made known.

Mr. MCCORMACK. There is now a Deputy Chief of Staff for logistics, is that right?

General UNCLES. There will be.

Mr. MCCORMACK. That is a new office?

General UNCLES. That is correct.

Mr. MCCORMACK. Under him will be chemical, medical, engineers, quartermaster, signal and transportation.

General UNCLES. The seven technical services will be under the Deputy Chief of Staff for Logistics.

Mr. MCCORMACK. Also under him and for his services the logistics staff?

General UNCLES. Right.

Mr. MCCORMACK. Heretofore, those technical services did report, or could report direct to the Chief of Staff, could they not?

General UNCLES. Yes, sir; there is nothing in this new organization that will preclude that so far as I know. In the present organization, not the new one that you are referring to, those technical services are grouped under G–4 just as they are shown on your chart grouped under the Deputy Chief of Staff for Logistics. And just as they could report directly and did report directly to the Chief of Staff under the old organization, I am sure they will also do the same under this new organization.

Mr. MCCORMACK. That has not been definitely settled, yet you have had direct working relations with civilian and military service elements of Army staff. And additional direct responsibilities to Assistant Secretary, civil-military affairs are indicated. But that does put those technical services down a step lower, at least, than in the present organizational setup, does it not?

General UNCLES. I believe not, sir. They are under, presently, G–4; according to that chart, they will be under the Deputy Chief of Staff for Logistics. However, I know nothing beyond the details

that are on that chart that you have. The method or extent to which the subsidiary organizations are going to be affected has not yet been determined.

Mr. McCormack. In your statement, you say it is possible to find military officers with broad experience who have sufficient technical knowledge to assess the state of the art.

That is rather ambiguous language to me. I would like to have you amplify that if you will, particularly the words "assess the state of the art" and "who have sufficient technical knowledge." What kind of sufficient technical knowledge, and what is the state of the art, and so forth?

General Uncles. I believe by that we mean we can find a few officers who are scientists themselves.

Mr. McCormack. A few. Well now, you say that is different. You say it is possible to find military officers. We are dealing, of course, with a very complicated situation, are we not?

General Uncles. Yes.

Mr. McCormack. We are just practical men. I am not talking to you as a legislator to a military man. I have profound respect for you and every other man. I wore the uniform myself, only I was a private. And I thought a lot of that uniform and I respect everyone who has the uniform. So any questions I ask, don't draw inferences because you might do me an injustice and yourself an injustice. But we have here always the national interest of our country. That is uppermost, is it not? It should be.

General Uncles. That's right.

Mr. McCormack. We have the military who of necessity are identified with the world of discipline and obedience. That is true, is it not?

General Uncles. That is true.

Mr. McCormack. We have the scientist who is a very individualistic individual.

General Uncles. That is correct.

Mr. McCormack. Searching for the truth as he sees it, new discoveries, challenges; restraint and regimentation—restraint, discipline, two important elements. I do not think anyone has advocated before us the establishment of a civilian setup. Am I right, Mr. Chairman?

Mr. Riehlman. I think that is true, sir.

Colonel Betts. We had it during the war, sir.

Mr. McCormack. That was under wartime conditions and of course there was been testimony to that effect and no one, not even the Chairman of the Research and Development Board during the war said that in the absence of war, probably a year prior thereto, another emergency, grave emergency, he would not recommend that that be done except under those conditions.

Colonel Betts. We received some experience with that and it has been effective organization under the conditions under which it was developed.

Mr. McCormack. Yes; because an organization under war conditions might be different than under other conditions.

Colonel Betts. Yes; because an organization under war conditions might be different, exactly. Under present conditions, where there is a considerable amount of education in research and development in

the services that did not exist before the war, the situation is very markedly different today from what it was when OSRD was set up.

Mr. McCormack. You said you found a very few military officers in the Army who are qualified scientists. How many would you mean by few?

General Uncles. I would have to get the statistics on that. We have sent a substantial number of officers, you know, to civilian schools since the war who have obtained masters and in some instances doctors degrees.

Mr. McCormack. Very important, but you need more than that, do you not? You have to have the old experience.

General Uncles. Quantity.

Mr. McCormack. You have to have experience, too.

General Uncles. That is true.

Mr. McCormack. Well, what my questions were leading up to, General, because I am not cross-examining you, it is not my duty here—I am simply to inquire—do you think you have enough officers in the Army, qualified officers, to be commanding officers of laboratories that the Army has?

General Uncles. I do.

Mr. McCormack. What is your idea of the rotation system in relation to military officers in the field of research and development?

General Uncles. I deem it essential that officers rotate positions in the course of their career. I would like to see their tenure of office increased from what they are able to have now as a result of the rather rapid rotation. We are not able in many instances to leave officers in positions as long as we would like to; but we make a special effort to keep them relatively stable in the research and development field.

Mr. McCormack. I think that last observation—in other words, you believe that—I can see the theory of rotation but I cannot see the difficulty—I won't say, can't, because I have not made a finding yet but it is difficult for me to see the advisability of taking a man of research and putting him into Infantry unless it is on or in connection with something, some duty or assignment related to the practical aspects of research and development.

General Uncles. We feel the same way in research and development.

I might say now that General Ridgway is having a plan drawn up whereby officers who are qualified to be in research and development will have their careers much more closely oriented to research and development than they have in the past.

In other words, he would not go to an Infantry outfit and we hope—I don't know what the plan is finally going to be—we hope he will not go to an Infantry outfit where he will be divorced from the research and development angle.

Mr. McCormack. This is all informal—any one of you may answer.

Colonel Betts. We worry about this same problem, Mr. McCormack, very much.

Mr. McCormack. We hoped that you would give us your own views insofar as you can rather than official views.

Colonel Betts. I know the two doctors are dying to say this, that from the point of view of management of research and development, there are two very important factors. One, you must know about what we call the state of the art. That means what is the technology

in the particular field in which you are interested. How far has medicine progressed so that you might have a solution to an immunization for cholera, that sort of thing.

In other words, we must have people in the military, not in uniform, necessarily, but in the military who know everything there is to know about the technology that is involved. At the same time, they are working in a vacuum unless they can work on a team with people that know what the military really needs.

In other words, there is no sense in developing a helicopter that mounts a 16-inch gun if, in the judgment of the military people that have worked with equipment, there is no practical application for such a device. They must work together. It is not particularly appropriate that the military people as such be scientists but they must have a good enough technical background to work with the scientific team on a sensible basis. It makes no sense to put a man in the military uniform next to a scientist if he is so devoid of any technical background that he cannot understand what the scientist is talking about. At the same time, it does not make any sense to put a scientist in the program who is not at all interested in the needs of the military. Our best and strongest team for research and development is a careful integration of the two elements. This is what the Army is trying to accomplish.

Military men who have been in research and development have to be taken out on occasion to keep them in touch with what is happening in the rest of the Army.

Mr. McCormack. Do you distinguish between basic and some of the other divisions of research and development?

Colonel Betts. Yes, sir; under these conditions you certainly would. In the case of basic research there is no reason there should be more than an orientation or relevancy to military problems.

Mr. McCormack. Every part of your research and development starts with the basic.

Colonel Betts. That is very right. It starts from it.

Mr. McCormack. When I say "dreamer" I say that most complimentarily.

Colone. Betts. The man who goes off into new fields wants to be encouraged to be as free as you can keep him so that he may do this without fetters.

Mr. McCormack. I wanted to hear from you. I would like to get your views.

Dr. Vance. I think Colonel Betts has made the point which I will stress. The important thing is that the military man understands science. He does not have to have an array of facts in his mind. He does not have to know the laws of thermodynamics and all the principles of inorganic chemistry, we will say. He has to know what is good for science and what is bad for science, what its limitations are, what its potentialities are; what science can do and what it cannot do, how to develop that atmosphere that makes science flourish.

Mr. McCormack. That in itself is a specialized field.

Dr. Vance. This is a matter of education. I do not mean academic degrees; it is a matter of feeling, reading, and willingness to listen to the opinions of those who have spent their lives in science. Colonel Betts is a good example of an officer who understands science. He is a good example and he has spent 5 years in research and development.

Mr. McCormack. If you have an officer who is in command whom the technical men respect for his technical knowledge, there is a greater respect for him as the commanding officer in the making of his decisions than if he has to just lean on somebody and have them make the decisions for him.

Dr. Vance. My own opinion is that in a military establishment where there are research and development activities, the military man should feel that it is up to him to give the support necessary for the research and development program. He does not have to take personal responsibility for guiding that program. He has scientists who should do that and the officer must make them feel they belong to the team.

Mr. McCormack. That is all wonderful when you have men who have the team mind but suppose you have men who have not got the team mind?

Dr. Vance. That is not the general situation, Mr. McCormack.

Mr. McCormack. What is not the general situation?

Dr. Vance. The situation in which they do not have the team mind. I will say the general situation is that they do get along. This is an ordinary management problem.

Mr. McCormack. Is there not more opportunity for team mind if you have military officers who have devoted their military careers to the field of research?

Dr. Vance. I would not oppose this idea. I just say——

Mr. McCormack. Than a man, a military officer who has not?

Dr. Vance. The military man has to bring to this team a knowledge of military requirements. That is his job.

Mr. McCormack. Above all, he has to have a lot of good commonsense.

Dr. Vance. Surely.

Mr. McCormack. He has to have a minimum of the military spirit in order to be successful when he is dealing with scientists, I would say.

Colonel Betts. A good feeling for research and development.

Dr. Vance. He cannot have a dogmatic approach to everything.

Mr. McCormack. I noticed you had a gleam in your eye.

Dr. Power. I would like to give you a few facts with regard to the Ordnance.

Mr. McCormack. I am just searching now.

Dr. Power. In research and development of the Ordnance Corps, we have a total of 404 officers assigned.

Mr. McCormack. Where?

Dr. Power. In the Ordnance Corps only. We have assigned a total of 404 officers.

Mr. McCormack. You are not stuck under this new setup 'way down below, are you?

Dr. Power. I have not seen the new organization.

Colonel Betts. He is in the Ordnance Corps Technical Service; yes, sir.

Dr. Power. These 404 officers, their careers indicate they have spent about 80 percent of their time in research and development operations; the other 20 percent is spent in field service getting the military leavening that Dr. Vance spoke of. I think 80 percent of the time gives them pretty good time in research and development.

As far as their education is concerned, almost without exception these men have gone to advanced civilian universities; almost all of them have master's degrees; 12 of them have doctor's degrees.

The men who actually direct the research laboratories, such as Aberdeen, Watertown, and so forth, are the men who are best qualified primarily on their technical basis rather than on their military basis. All of these people have had enough military training in the field so that they have a good comprehension of the military problems. I think the record speaks for itself that we do select people who have the technical background. The main thing I think we get from the officers in addition to the military leavening that they provide is that we get people who have a greater devotion to duty than some of the civilians outside who would have the same capabilities. We can get better qualified people in uniform than on the average we can get as civilians.

Mr. RIEHLMAN. You mean as scientists?

Dr. POWER. I think that is right, sir.

Mr. RIEHLMAN. I would like to have your statement again. I want to get that correct.

Dr. POWER. I think we can get better qualified people in uniform.

Mr. RIEHLMAN. Who are scientists, than you can get outside?

Dr. POWER. People who come and stay as a part of the organization. This is not true without exception because we have very many civilians who are just as devoted to their duty and who will stay with the Government organization in spite of the fact that they can get higher salaries outside.

Mr. BALWAN. What you are saying is that it is difficult to get scientists to come in as civilians.

Dr. POWER. Exactly.

Mr. BALWAN. It does not speak of the quality of work of your scientist. You are just saying that it is easier to work technical people when they are in uniform because of their devotion to duty and the kind of pressure you can put upon them from your rules and regulations than you can from civil-service scientists who come into a program.

Dr. POWER. No; I am speaking only of the very top level, the administrative level. I think in the middle levels this is not so. But when you get to the place where you demand a man who has high administrative ability, who has the technical background to handle his job and who can command the respect of people who are working for him, I think it is in general easier to keep men who are officers than it is to keep men who are civilians.

Mr. MCCORMACK. Why the difficulty in getting civilians? There must be some reason.

Dr. POWER. There are lots of reasons, sir.

Mr. MCCORMACK. They must be outside of the money, now. The scientist would make all the sacrifices. There must be some other reasons.

Dr. POWER. There are.

Mr. MCCORMACK. What are they? Do you know?

Dr. POWER. Academic freedom. A lot of them prefer to work for universities at even lower salaries than for the Government because they do not have to put in a 40-hour week and they do not have to punch time clocks. That appeals an awful lot.

Mr. McCormack. They do punch time clocks in the Army?

Dr. Power. Not the Army but some of them do in industry.

So academic freedom is certainly a point. This is not competition.

Mr. McCormack. Recognition for their contribution, and so forth. I can see that.

Colonel Betts. The ability to publish. So much of the work they do in the military is classified

Mr. Riehlman. Let me ask the doctor: Could you do better work if you were in uniform?

Dr. Power. No, sir.

Mr. Riehlman. I am very anxious to find out because you have made a pretty strong statement here about the better work that you can get out of these scientists if they are in uniform. We are interested in specific things, not just generalities.

Dr. Power. I am only speaking in generalities. Specifically, I do not think I could do as well in uniform as a civilian in my own case.

Mr. Riehlman. That is what we are after. Let us elaborate. I wonder for what reasons.

Dr. Power. Well, primarily, I think because I am working with an organization of civilians and officers who are extremely high quality. I think that the research and development people that the Army has and specifically the Ordnance has, are as high quality as you can find anywhere in the world. And I think the most important thing I can get out of a job are my associations. These I have in the Ordnance Corps.

Mr. Riehlman. In other words, you feel that your associations are proper, you can develop your own activities and your own thinking better in that field.

Did you have another question, Mr. McCormack?

Mr. McCormack. Doctor, I will not ask the General this question: What is your view, if any—if you haven't considered it tell me frankly—but what is your view about an Under Secretary of the Army for Research and Development—Assistant Secretary.

Dr. Vance. I will tell you what my personal views are. I think it is unnecessary for this reason: that his job would be exactly the job that is now held by General Uncles. There is no point of having two men do the same job.

Mr. McCormack. Suppose the general gets out and some other general comes in.

Dr. Vance. General Uncles is the second officer who has held the job and General Nichols the first.

Mr. McCormack. General Nichols is with the Atomic Energy Commission.

Dr. Vance. I have no reason to believe that there would not be a competent officer given that spot when his tour is up.

Mr. McCormack. I do not want to interrupt your train of thought.

Dr. Vance. As long as there is a good working relationship between the Chief of Research and Development and the Assistant Chief of Staff, G–4 who has the technical services and the officer who is in charge of the G–4 research and development activities, the present arrangement is good.

Mr. McCormack. The Under Secretary of the Army has a lot of other responsibilities besides research and development.

Dr. VANCE. I thought you said, what was my opinion of an Assistant Secretary who would spend all of his time on research and development.

Mr. MCCORMACK. I say the Under Secretary now has an awful lot of responsibilities. He has research and development; he has an awful lot of the technical services. That is quite a load for any man to carry; is it not?

Dr. VANCE. Of course, it is; yes.

Mr. MCCORMACK. Don't you think that research and development is important enough in itself today, in the world today, and as we project our mind into the future, if we can, that there should be an Assistant Secretary of the Army for Research and Development.

Dr. VANCE. I think the Army organization of research and development and the one that may be developed in the near future is a very effective way of doing it. The idea of Assistant Secretary for Research and Development, it seems to me, would duplicate the job that the Chief of Research and Development in the Army has.

Mr. MCCORMACK. What value do you attach to the importance of not only having the civilian mind, have an opportunity of expressing himself with some degree of freedom, but of having the views represented to someone, some other civilian in a high position in the line of command?

Dr. VANCE. I think this is very important. The way——

Mr. MCCORMACK. You and about 7 or 8 or 9 civilians are in the line of command, the highest line of command; are you not? It is divided among 8 or 9 of you, different activities?

Dr. VANCE. Yes, sir.

I would like to call your attention to one little box up here, as you face the chart, on the left, of the Secretary of the Army, where it says scientific advisory panel. This brings the thinking of some of the best scientific minds in the country right to the top of the Army.

Mr. MCCORMACK. Are they permanent? They are advisory; are they not?

Dr. VANCE. They are advisory.

Mr. MCCORMACK. How often do they meet?

Dr. VANCE. About annually, so far. We are devising a system whereby we will meet at least twice a year, and a steering group will meet more frequently. The head of that is Dr. Killian of MIT.

Mr. MCCORMACK. We had Dr. Killian before us; a remarkable man. But you can't go to them on everyday matters or matters arising in the course of your activities.

Dr. VANCE. If we thought it was a matter of such significance that we wanted their support or advice, they invite us to call them informally.

Mr. MCCORMACK. Could you bypass the general?

Dr. VANCE. He asks me regularly to call——

Mr. MCCORMACK. Suppose he asks you—could you bypass him?

Dr. VANCE. Yes, sir; I am not sure what you mean or what you imply by "bypass."

Mr. MCCORMACK. I can see you and the general get along pretty well. But suppose that you and the general had a difference of opinion and the general had such strong convictions on it that he thought his decision was final. He is the commanding officer. He is the fellow to make the final decision, is he not?

Dr. VANCE. No, sir.

Mr. MCCORMACK. He is not? Explain that now.

Dr. VANCE. The Secretary of the Army makes the final decision.

Mr. MCCORMACK. All right. The final decision within his section as far as you and the general are concerned.

Dr. VANCE. It would be his opinion.

Mr. MCCORMACK. Yes. Could you go over to the Under Secretary of the Army or the Chief of Staff yourself?

Dr. VANCE. Yes, sir; I could.

Mr. MCCORMACK. Without the general's permission.

Dr. VANCE. I have never sought his permission in seeing any of the generals above him. If I felt very strongly about it I would feel that it was my duty to put another point of view to the top.

Mr. MCCORMACK. I can see that now but at the same time you might say there would be an obligation to retire.

Dr. VANCE. As an alternative.

Mr. MCCORMACK. I can see where it would be your duty but even if it meant your own personal sacrifice. I can understand that.

Could you do it without that freedom of mind?

Dr. VANCE. I feel so.

Mr. MCCORMACK. All right. I do not want to put any questions that would put suspicions into the general's mind. What I want to know is, Do you think that you and eight others should be the highest civilian authority within the Department of the Army? That is no reflection on the general. I have profound respect for the general. I am talking about civilian now, because according to the line of command it comes down through to the general, the Under Secretary of the Army, but he has many other duties.

Colonel BETTS. He has a civilian specialist, special assistant, who is concerned very largely with research and development. It does not appear on that chart.

Mr. MCCORMACK. So does the Air Force. While he could not give an official opinion, he would welcome having an Assistant Secretary of Air because he has all the responsibilities practically and obligations and the Assistant Secretaryship would give more authority. Is there any question about the importance of research and development in connection with the national interests of our country?

Dr. VANCE. I can answer that categorically. So far as my experience is concerned, there is no question in the minds of any military man on the general staff with whom I have come in contact.

Mr. MCCORMACK. It might be what comes out of the brains of one of those humble men who are scientists—and they usually are a humble individual—something that might save our country.

Dr. VANCE. I have seen no impediment to the free flow of suggestions or thought.

Mr. MCCORMACK. You think that outside of the Under Secretary of the Army with his many other duties, that this organizational setup, with you and eight other civilians on the same level, constitute in the highest civilian level within the Army, the setup is a satisfactory one?

Dr. VANCE. Yes, sir; but please don't omit the great force and support of the thought that is included in the scientific advisory panel. I have the greatest faith in the wisdom of 10 men who are presently appointed to that panel which is now being organized. This brings

in the kind of thinking and experience which can never be brought into the Army permanently even in an Assistant Secretary.

Mr. McCormack. I would like to have you read Dr. Killian's testimony some time in that respect.

Dr. Vance. I have discussed this with him some.

Mr. Balwan. Mr. McCormack, in the Davies committee report there is mention made that greater interest in support among civilian scientists must be built. We propose that the scope of the Secretary, of the scientific advisory panel, be widened to embrace all Army research and development plans and operations. Currently, this group advises the Secretary and the Chief of Staff only on those specific projects assigned to them. This has not constituted an adequate challenge.

Has anything been done to——

Dr. Vance. This is the activity that I was going to describe, Mr. McCormack.

Colonel Betts. This was the augmented activity Dr. Vance mentioned. We are in the midst of drawing up a new charter for the Army scientific advisory panel which will have them meet on a more periodic basis, will give them a permanent secretariat, and enrourage their constant interest in more or less day-to-day problems.

Mr. McCormack. I can see that it is probably better to wait and see what develops in connection with that.

What did Dr. Killian say about the Assistant Secretary? Do you remember?

Mr. Balwan. No, I don't, without refreshing my memory on that point. He did make a point, though, with reference to the Army's organization that he felt research and development should not be attached to the supply and procurement agencies, that in good management practice more and more research and development is being taken away from the production managers and the sales managers and put in as advisory to top staff levels.

Mr. McCormack. With teamwork between them.

Mr. Balwan. That's right.

Colonel Betts. Which is what we expect to get out of the exercise connected with reorganization of the Army. We expect to get a separate staff section responsible only to the Deputy Chief of Staff for Plans and Research, whereas we are now scattered among the four G's with the major part of our staff in the Logistics Division.

Mr. McCormack. Mr. Chairman, I think I might state to you, General, that this is not an investigation. We do not want you gentlemen to think that. We are in executive session. We are just searching to see in what way we can make a contribution in conjunction with the services and all others toward the establishment of an organization that will get the maximum results for the national interest of our country. So don't think that this is any investigation.

General Uncles. We are anxious to assist you by furnishing information, Mr. McCormack, which will enable you to do that.

Mr. Balwan. Mr. Riehlman——

Mr. McCormack. We have evidence that the scientists are very much disturbed and they hesitate to come into the Government service, Dr. Vance, because of reasons other than salary and reasons other than this academic freedom, the opportunity of expressing their views, such as they have in the colleges.

Of course, we realize the faculty of a college is somewhat different than being in military science. I think they do. But we have evidence that there is a feeling of fear in their mind of some little thing that might have happened many years ago being played upon, security reasons. What do you know about that?

Dr. VANCE. I think Vannevar Bush——

Mr. MCCORMACK. I do not have in my mind any particular case now.

Dr. VANCE. I think Vannevar Bush discussed this very well indeed in his article in the New York Times Magazine section a couple of weeks ago. I do not think I could add very much to that.

Mr. BALWAN. Do you concur in his views on that?

Dr. VANCE. Yes; that was very well put. These reasons, of course, are not associated with the civil-military relationships that we have been discussing here. They have their foundation, more, I think, in the security system as he described it.

Mr. MCCORMACK. Aren't they something that probably will pass? In other words, commonsense has got to assert itself.

Dr. VANCE. I feel so.

Mr. MCCORMACK. It is unfortunate but the way I view it is that those, or periods or incidents that we are meeting today and other generations have met in some form or another in the past, and they pass and they are very annoying while they exist but that is more or less of a temporary nature, I would assume.

Dr. VANCE. This is my personal feeling about it.

Mr. MCCORMACK. Because the commonsense and the realities of the situation have to assert themselves sooner or later. So I agree that is different from what we have discussed.

Dr. VANCE. On this subject it is of some interest to know that Dr. Shockley of the Bell Laboratories who, incidently, has been a member of the Army Scientific Advisory Panel, has agreed to come in as director of research in the weapons system evaluation group. This is very recent but he has agreed to do this. It is unlikely, I think, that he would have agreed to take time from his work if he did not feel it was worth doing and that he as a scientist had an obligation to help, too.

Mr. RIEHLMAN. Any other question, Mr. McCormack, on that point?

Before we get to another subject, we were talking about rotating of the officers in their responsible positions to the general here about his own shop. Take, for instance, and it is a good illustration, we have here today a person who has been testifying, a colonel who has been in his present position for 4 years, if I am correct—Colonel Betts; well versed, and has a great understanding of this problem and experience, is outstanding, apparently, from what the general has just told me, and I think he would concur in that; one of the finest he has had.

Unfortunately, he is going to be rotated very soon. He is ending his 4 years.

Now, the question arises where he is going to be placed and who is going to replace him. It is a big problem and I think that the committee's interest, General, and it is deeply concerned with this program because we have felt, and I think probably you would agree with it, that something should be done. Men who have these out-

standing qualifications in a field that is so necessary at this time for the survival of our country that they should be rotated in another field that is coordinated in some way with this activity, and that a man who replaces him should have some knowledge of this activity. I think it would be very fine for the record to have Colonel Betts' background and experience. I would like to have you give that to us if you would, Colonel.

Colonel BETTS. I came into research and development in 1945, Mr. Chairman, when I was assigned to the Los Alamos Laboratory where my orders to duty said, report to Dr. Bradbury for whatever duty he may give me. I ended up as a sort of executive assistant to him to take off his shoulders the burden of running the Laboratory from the administrative point of view and to furnish him the technical services which he needed such as mechanical shops, maintenance of buildings, handling of personnel matters and travel and supply and all of that sort of thing.

I used to sit with him as a member of the technical board that ran the scientific program of the Laboratory as a secretary to this board, I think partially for my education and also because none of the scientists particularly wanted to take notes at the meetings. I had that position for about 3 years. Then, under the rotation policy which we decry and which I did at the time in writing and personally, I was ordered to a routine position on an engineer staff since I am Corps of Engineers by background.

Mr. BALWAN. What year was that?

Colonel BETTS. That was in 1948. I lasted in that assignment just 9 months when General Nichols was asked for the name of an officer with an atomic weapons background for assignment to duty on the Army General Staff. I reported there the first week in January 1949, and I have been in research and development, that aspect of the Army General Staff since that time.

In other words, I was in the Research and Development Division when the present office of the Chief of Research and Development was established in January 1952. I went as executive to General Nichols and remained in that assignment when General Uncles took over.

So I have had almost 9 years of actual experience in research and development from what I would call an executive or management point of view. I am not a scientist. I am deeply interested in the technical and I make it a point to try to know enough about the technical that, when I discuss the program content with people like Dr. Vance, Dr. Power, and other scientists in the program, I can understand their problems as well as understand the management problems associated with the program. There is no question in my mind but what my experience would be best used for the Army if I could stay in research and development.

Mr. MCCORMACK. Is that not a specialized field in itself, Colonel, the scientific administrator?

Colonel BETTS. It is very much a specialized field. I am sure that General Ridgway has recognized this in laying on the staff an action which he started several months back. He demanded that the personnel section, G–1 of the Army, establish some means of controlling the assignment of officers to research and development in order to get better continuity in the management of military personnel in research and development.

Mr. McCormack. Do you know if he has a recognition so that an officer will be recognized by way of promotion which, of course, if I were in the service myself, it is a natural ambition for people to progress.

Colonel Betts. That is part of the problem; no question about it.

Mr. McCormack. They can settle that not by legislation but organizationally; administratively they can do that. It is simply a question of leadership, the clear object of leadership of that sees the importance of research and development and the necessity of both groups, the military and the civilian cooperating together as a team for the maximum, and that comes back to the development of human beings, their minds, in these careers.

Colonel Betts. That is right.

Mr. McCormack. I should think——

Colonel Betts. I think that General Ridgway sees this problem. I think from our present staff exercise we will get a better recognition of officers in this program and attempt to keep them in it. I might say that in defense of my rotation, that I have been selected to go to the Industrial College of the Armed Forces. Since this is the first military school I have gone to since 1936, I think I am somewhat overdue for further military education. The Industrial College was selected because it was felt by General Nichols and General Lemnitzer, who made the recommendation for this, that it would be a proper rounding out of my career in research and development.

Mr. McCormack. Is that related to research and development?

Colonel Betts. It plumbs the industrial potential of the country. Fundamentally, a part of this is the industrial potential, the industrial capability for research and development.

Mr. Riehlman. Any other question on this point? Mr. Lipscomb?

Mr. Balwan has some questions that he would like to ask.

Mr. Balwan. I don't know how we want to proceed here. The general had a very well-prepared statement and I am noticing more and more that there are answers to the type of questions we have just discussed here.

For instance, in line with Colonel Betts' testimony there is the question: "Does the military organization of a research and development program tend to create conditions which retard the work of scientists, or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?"

That appears on page 10 of their prepared statement. They do acknowledge it is certainly true that rules and regulations associated with the military do tend to create unfavorable conditions, unfavorable to scientists, unless there is a strong effort at command levels to resist this tendency. The fundamental strength of military organizations lies in the quality of its discipline. The average real scientist tends to resist dogmatic direction associated with military discipline. These two divergent tendencies can be controlled successfully by the assignment to command positions of the right caliber of officer who understands this distinction.

It seems to us that they are recognizing this problem, Mr. Riehlman, and I am glad to see it in this statement here.

Mr. Riehlman. It is apparently very true from the statement made by Colonel Betts, and I am very happy to know that because it is

very wonderful to know it and certainly has been of great interest to this subcommittee.

Did you have anything you wanted to add to this, General?

General UNCLES. No; except that chiefs of the technical services are extremely careful in picking the right type of people to command their laboratories, and I think that they have been quite successful.

Mr. BALWAN. Mr. Riehlman, if I may proceed, the general does have a prepared statement which we always have and can have inserted in the record as it is.

Mr. RIEHLMAN. That is right.

Mr. BALWAN. We can probably build some questions around comments by the general to the summary of inadequacies existing in the research and development organization of the Army as expressed in the Davies report and, with your permission, I would like to describe it a little more fully and discuss the statement regarding inadequacies and have you comment as to what you think about this.

Mr. LIPSCOMB. What is this report you are reading from?

Mr. BALWAN. This is the Davies Committee report on the organization of the Army of the Advisory Committee on Army Organization, dated December 18, 1953. I can give you the history of that report.

The Rockefeller Committee was set up to study the organization of the Department of the Army. That resulted in the Reorganization Plan No. 6, which reorganized the Department of Defense, the Office of the Secretary of Defense, gave the additional Assistant Secretaries and things like that.

Since there was not time to make studies after the new administration came in the President requested that additional studies be made by the Departments themselves and the Davies Committee was set up to make a study of the Army.

Reading from the Davies Committee report it says, on page 58:

> Despite these advances, the Army's organization for research and development is not now adequate to the need. Four deficiencies can be summarily stated:
>
> 1. Responsibility for leadership is diffused among 2 members of the civilian secretariat, the Chief of Research and Development and the 4 Assistant Chiefs of Staff. The advances made by the Chief of Research and Development within recent years are attributed in principal part to the unique talents and capacity of an individual officer, not to the effectiveness of the organizational mechanisms through which he worked.

The question would be what did they mean by the Chief of Research and Development? That is a position, is it, comparable to your position, General?

General UNCLES. That is my position.

Mr. BALWAN. They said that the advances were made and are attributed in principal part to the unique talents and capacity of an individual officer. Are they referring to any particular officer? There was only one before you.

General UNCLES. I presume they are referring to this particular officer, and that would be General Nichols, my predecessor.

Mr. BALWAN. What would your comment be on this particular deficiency, and how you are trying to overcome it?

General UNCLES. I have recommended that research and development activities be gathered in from these various elements that were mentioned there, the four staff sections.

Mr. BALWAN. Who were the four Assistant Chiefs of Staff they were referring to?

General UNCLES. G–1, G–2, G–3, and G–4.

Mr. BALWAN. Each one of them, G–1, G–2, G–3, and G–4 had a chief of research and development?

General UNCLES. Not necessarily so-called. The G–4 is the only one who is an individual with the title of Chief of Research and Development, but they each had a research and development entity within their organization, and I recommended that under this new reorganization plan Mr. McCormack just mentioned, all research and development activities be gathered in from those four G sections and be put in my office.

Mr. BALWAN. So that research and development would not receive any command direction, line of command from G–1, G–2, G–3, and G–4 from the General Staff?

General UNCLES. That is correct. However, we would coordinate our activities with them.

Mr. BALWAN. General Staff would have a staff position, and just what was it intended to be? The general staff work would be staff work to you.

General UNCLES. Exactly.

Mr. BALWAN. In addition to that, the actual operation of the research and development remains in the technical services?

General UNCLES. We do not contemplate any change at all in the actual operation of the program by the technical services.

Mr. BALWAN. What other changes had you contemplated besides taking the research and development responsibility from G–1, G–2, G–3, and G–4 and placing it in you?

General UNCLES. Organizationally?

Mr. BALWAN. Yes.

General UNCLES. That is the only action we contemplated organizationally. We expected that the technical services would continue to operate the program as I mentioned.

Mr. BALWAN. This criticism merely says that any advances may be attributable to the talents and capacity of an individual officer, not the effectiveness of the organizational mechanisms. They do not spell out any of the particular weaknesses in the organizational mechanism and you apparently feel only one weakness existed.

General UNCLES. I do not want to interpret the Davies report since I was not a member of the Commission. However, I did appear before the Davies committee and one aspect of organization that they were skeptical of was the relationship between my office, Chief of Rese rch and Development, and the Deputy Assistant Chief of Staff, G–4, for Research and Development, whose block is shown down here on the chart. You will notice that there is a dotted line.

Mr. BALWAN. Why is the general in charge now of G–4?

General UNCLES. General Hertford. Of Research and Development?

Mr. BALWAN. Yes.

General UNCLES. General Hertford. In other words, I deal directly with General Hertford. He is my executive agent. In my own office, for instance, I have only Colonel Betts, Colonel Mansfield, and Dr. Vance, plus some clerical help.

General Hertford is my executive agent and his staff do my work for me. I deal directly with him, bypassing General Palmer, who is G–4.

That arrangement works quite well. General Palmer understands the situation. General Hertford and I work together quite well like that.

The basis for the skepticism of the Davies committee was the chance that a future G–4 might insist that the Chief of Research and Development deal only through him and not with a subordinate element. In such a case the present organization would bog down.

Mr. BALWAN. What is the status of understanding between the Chief of Research and Development and the Deputy Chief of Staff for Research and Development in G–4? Is there an understanding between two generals or do we have a set of operational instructions?

Colonel BETTS. There is a written direction from the Chief of Staff which designates him as the executive agent of the Chief of Research and Development.

Mr. BALWAN. Could you provide the subcommittee with that?

Colonel BETTS. Yes.

(Directive referred to to be supplied by Colonel Betts:)

Mr. BALWAN. You would say that those actions were taken to answer the criticism that the responsibility for leadership was diffused at that time between those two members?

General UNCLES. Yes.

Mr. BALWAN. Action has been taken on that?

General UNCLES. We have recommended it. What the decision will be, I don't know. This is a broad picture of the organization, of the staff.

Mr. MCCORMACK. That was announced at Quantico recently by Secretary Wilson.

General UNCLES. The subsidiary organizations that will fit in there have not been announced yet.

Mr. MCCORMACK. That has not been promulgated yet, as I understand it.

Colonel BETTS. Only to the extent that it was put out at Quantico and each staff section is working on that.

Mr. RIEHLMAN. Do you have any other questions on that point, Mr. Lipscomb?

Mr. LIPSCOMB. No, sir.

Mr. RIEHLMAN. Do you have any other questions on this point, Mr. McCormack?

Mr. MCCORMACK. No.

Mr. RIEHLMAN. Proceed with the next point, Mr. Balwan.

Mr. BALWAN. The second of the four deficiencies stated by the Davies committee report was:

> 2. No adequate means exist to coordinate and actively stimulate the efforts of all engaged in research and development in many organizational units throughout the Army. The bulk of these activities are performed in the technical services; four-fifths of the annual funds available for research and development are allocated to the Ordnance, Signal, and Chemical Corps. There is no effective coordination of the activities of two or more services engaged in research on a single project; for example, the development of a land mine and the vehicle by which it is to be laid.
>
> The opportunity of the Chief of Research and Development to stimulate the effectiveness of materiel development is not clear, and can be effectuated only with the continuing concurrence of the Assistant Chief of Staff, G–4.

Could you explain that criticism and anything that has been done?

Mr. RIEHLMAN. I think in all fairness to the general we should ask first, "Have you read this report?"

General UNCLES. Oh, yes.

Mr. RIEHLMAN. And you understand it?

General UNCLES. I have spent some time with it.

Mr. RIEHLMAN. I want to be sure you are familiar with the criticism that was leveled against the Department so that we are not asking you questions which you are not familiar with and have given no study to.

General UNCLES. May I see that?

Mr. BALWAN. Surely.

General UNCLES. I never did understand what they meant by—

no adequate means exist to coordinate and actively stimulate the efforts of all engaged in research and development in many organizational units throughout the Army.

Then they go on further in that paragraph to say:

There is no effective coordination of the activities of two or more services engaged in research on a single project; that is, the development of a land mine and the vehicle by which it is to be laid.

I will call on Colonel Betts to answer that.

Colonel BETTS. This was primarily a further objection to the fact that the Chief of Research and Development who has the responsibility for the program content had no staff of his own to do the job. It was primarily directed at that, and it was partially directed at a conviction on the part of the people of this committee that the technical services had too much individual autonomy.

The corrective action that has been taken is that the Army went through a considerable period of study seeking to develop a plan that would implement the Davies committee report which was then submitted to Mr. Wilson and then in turn the Army was told at Quantico that Mr. Wilson had approved a different version from that proposed by the Davies committee.

So far as the Chief of Research and Development is concerned, we consider that the answer lies in an effective organization immediately responsive to the Chief of Army Research and Development and in an adequate staff so that requirements can be properly integrated with the programs.

The problem of the mine and mine layer development refers to the development of a piece of ordnance equipment and a piece of the Corps of Engineers' equipment that can be coordinated through the G–4, Research and Development Staff now as it presently exists.

Mr. RIEHLMAN. Let us find out how much coordination is going on between the Ordnance Department and these other departments. That criticism, of course, certainly is to some degree levied at your department too because of the question of coordination in the different departments of the Army.

Dr. POWER. I do not think that the difficulty which arose with respect to the mine and the mine planter was any greater than you would expect to find if they were 2 branches of ordnance or 2 branches of engineers. A mine is primarily an explosive device, and a planter is a special purpose vehicle. It was necessary to have people familiar with the use of explosives and others familiar with the heavy earth-moving equipment. Having two groups working on associated problems there is a problem in developing effective coordination.

I think the coordination in this case was as good as you can expect in any such operation. I do not think there was anything that was

inherent in the fact that one was the Engineers and the other was Ordnance.

Mr. RIEHLMAN. My question is what was your own personal feeling about the coordination of these activities between your department, and certainly you must have some connection with Dr. Vance in his activities.

Dr. POWER. This is right. In the final analysis, however, the important coordination in a research and development program is the coordination between the individuals who are doing the actual research and development work and not the administrator on top, and this means you have to know your counterpart in the other organization, whether it is a part of the same corps or part of a different corps.

What is required is not an organizational pattern or any paper structure but an opportunity for our people to get together and work closely with the people where the coordination is required.

I think we have this in general. There are specific cases where the coordination broke down.

Mr. RIEHLMAN. You say you have it in general. Have you any recommendation that you can give to the committee that would better the condition?

Dr. POWER. I do not believe that any general paper reorganization will improve it.

Mr. RIEHLMAN. I am not asking for a paper reorganization. I am asking for a general statement on your part if you have any idea.

Dr. POWER. No; I am afraid I do not know of anything specific.

Mr. RIEHLMAN. You feel that the coordination is as good as it can be?

Dr. POWER. For an organization as large as the research and development organization in the Army, I think that you are bound to have coordination problems, no matter how you reorganize.

Mr. BALWAN. This is not the valid statement of practical inadequacies.

Dr. POWER. I do not believe that the statement really is valid in terms of applying to the existing organization. In other words, I do not think existing organization caused this situation in here.

Colonel BETTS. I do not understand why the Davies committee selected that example, because the Corps of Engineers mine planter was very well coordinated with the Ordnance Department mines, and the Corps of Engineers equipment will lay them.

Mr. RIEHLMAN. I am not taking that specific example. Mine was a question of the overall coordination.

Colonel BETTS. I think it will help if I tell you this, we have in each technical service what we call a technical committee. As each technical service—or it may come from the staff—develops a new project, it is introduced into the technical committees. On the Ordnance Technical Committee for ordnance there is a member of each of the other technical services and the Navy and Air Force are also invited to send representatives. By and large where they know they have interest in the program they do send representatives. So, in the very early idea stage of a new project it is mulled over by all the technical services and by the other two services.

If any one of these individuals takes issue with that recommendation, then it must come up to the General Staff for decision. The chief of the technical service cannot go ahead with it unless he has

agreement from every one of these elemnts, including the Navy and Air Force. If any one of them objects to the proposal of the technical services, the General Staff is asked to explore the proposal further and then make the decision.

Mr. RIEHLMAN. Do you have a good representation at those meetings when these matters are discussed?

Colonel BETTS. Yes, sir, every technical service must be represented. If the designated committee member cannot be present for one reason or another, he must supply an alternate of supposedly comparable technical qualifications.

Mr. LIPSCOMB. Are those technical committees made up of both military and civilian?

Colonel BETTS. They could be either. In other words, the chief of one technical service is asked to supply a member for a technical committee of another technical service; he might choose either a civilian or a military man.

Mr. RIEHLMAN. In Ordnance who is responsible for that?

Colonel BETTS. The selection?

Mr. RIEHLMAN. Yes.

Colonel BETTS. Probably the executive to the Chief of Research and Development. Colonel Barclay, General Simon's executive, would probably make the decision.

Mr. LIPSCOMB. Is he down in the technical services block?

Colonel BETTS. That is right.

Mr. LIPSCOMB. Who is the immediate superior to the technical staffs? Is it G–4 logistics?

Colonel BETTS. G–4 logistics.

Mr. LIPSCOMB. And he is also in charge of the Army laboratory?

Colonel BETTS. That is right, through the Chief of Technical Service. The Chief of Technical Service runs his own laboratory, but G–4 logistics would be his next superior.

Mr. MCCORMACK. Do they rotate Army engineers around into other branches of the service?

Colonel BETTS. Not in any great numbers. People are detailed within other services.

Mr. MCCORMACK. But they stay within the branch?

Colonel BETTS. Yes.

Mr. MCCORMACK. Do they do it in Quartermaster?

Colonel BETTS. Yes.

Mr. MCCORMACK. They stay within the branch?

Colonel BETTS. Yes.

Mr. MCCORMACK. And Transportation?

Colonel BETTS. Yes.

Mr. MCCORMACK. They stay within the branch?

Colonel BETTS. Yes, but they will on occasion go with others.

Mr. MCCORMACK. But they stay within the branch?

Colonel BETTS. Generally, yes.

Mr. MCCORMACK. And Signal and Chemical also?

Colonel BETTS. Yes.

Mr. MCCORMACK. Ordnance?

Colonel BETTS. Yes.

Mr. MCCORMACK. Of course we know the Medical will because they are doctors.

Colonel BETTS. Yes.

Mr. McCormack. But the research and development, they do not do it as strictly as they do it in these other technical services?

Colonel Betts. We do not have a service called research and development.

Mr. McCormack. What are your views on that?

Colonel Betts. I think this is appropriate if we set up some means of managing military careers so officers do not get lost under research and development. In other words, if there is an Ordnance officer who proves to be technically competent and who demonstrates an understanding of research and development, say as a captain, someone should follow his career so that he is kept in research and development as much as it is practical to keep him, commensurate with his getting adequate military education and experience so that he doesn't lose his ability as an Army officer.

Mr. McCormack. What about the ability of the other officers in the technical services as Army officers?

Colonel Betts. Ordnance is one of the technical services.

Mr. McCormack. Yes, but engineering.

Colonel Betts. It would go further to the other technical services. In other words, the Corps of Engineers should have the same responsibility for worrying about which of the engineering officers has the research and development experience and should be kept in that work.

At the moment there is no Army policy which directs that each technical service manage their research and development personnel in that fashion. It is done in each armed service on the best judgment of the responsible people in that arm or service.

As Dr. Power mentioned the Office of the Chief of Ordnance keeps very close check. Their research and development people spend 80 percent of their time in that field. I do not think this is true of any of the research and development officers in any of the other arms. Of course, the major part of the Army's research and development is in Ordnance.

The next major part is in Signal and I think in the Signal Corps you would find very close to that same percentage, probably not that high. So it varies between technical services but the exercise laid on by General Ridgway should develop a picture that should direct that similar policy be adhered to in other arms.

Mr. Balwan. What is this exercise you are talking about?

Colonel Betts. General Ridgway directed G–1 to develop a plan for management of research and development personnel, career management of a type that has not previously been directed and G–1 is now developing such a plan.

Mr. Balwan. It has not been developed, I take it.

Colonel Betts. No.

Mr. Riehlman. How long ago was that direction developed?

Colonel Betts. I guess about 2 months.

Mr. Balwan. That sounds like a very encouraging device and project.

Colonel Betts. It is extremely encouraging to us because they have come to us for advice as to what we think ought to be done.

Mr. Balwan. I don't know if any of that is going on in any of the other services.

This is what I understand was the action taken on No. 2, that no changes have been recommended as far as the structure for carrying

out research and development, that it will remain in the technical services which have a better understanding between your shop and the other technical services, is that right?

General UNCLES. Yes. You see they again express their concern.

Mr. BALWAN. They make a very strong statement that—

No adequate means exist to coordinate and actively stimulate the efforts of all engaged in research and development in many organizational units throughout the Army.

And then they go on to say:

There is no effective coordination of the activities of two or more services engaged in research on a single project; that is, the development of a land mine and the vehicle by which it is to be laid.

Mr. RIEHLMAN. You have 2 doctors heading up 2 different divisions, am I correct?

Mr. BALWAN. No. One is on a different level. He is in Ordnance and the other is the deputy way up at the top.

Mr. RIEHLMAN. But certainly the doctor in charge of Ordnance has said that he doesn't feel, at least that there is any question about the coordination and he feels that it is being carried out as well as possible. Am I correct in that?

Colonel BETTS. Yes, sir.

Mr. RIEHLMAN. You certainly must have something to do with the coordination down the line, Dr. Vance.

Dr. VANCE. Well, I think these comments Mr. Balwan has been reading are really on the same point, remaking the point that all Army research and development activities will be coordinated more effectively if they are consolidated in one office.

Mr. MCCORMACK. Why wouldn't that be under an Assistant Secretary for Research and Development? You have one already and this is high line of command too.

Dr. VANCE. We do report through General Lemnitzer, Deputy Chief of Staff for Plans and Research.

Mr. MCCORMACK. But he has a lot of other jobs.

Dr. VANCE. Yes, sir, but the Assistant Secretary has a deputy and a special assistant.

Mr. MCCORMACK. But that doesn't put the civilian line of command on an Assistant Secretary.

Dr. VANCE. As it is now set up, General Uncles is the principal adviser to the Chief of Staff, to the Secretary of the Army and the Under Secretary on Research and Development matters. As it works now, he has the entire research and development staff in G–4 and in all the technical services to assist him and to assure him that he gets the best possible advice.

I do not believe a separate Assistant Secretary for Research and Development could do more. He too would have to call on the same staff and the same people.

I personally do not see what is to be gained. Of course, if you get a man like Dr. Killian he is bound to have an impact on the program, but we have some of the best brains in the country advising us directly.

I agree fully that all activities of research and development should be brought into one office. I personally do not see the gain of having an Assistant Secretary who does nothing but think about research and development. This is already being done. We have no other activities but research and development.

Mr. McCormack. What are your views?

Dr. Power. I am not directly associated with the Office of the Secretary, but I think it might be well to point out that there is just as much continuity in officers in their jobs as an Assistant Under Secretary in his. Civilians have shorter tours of duty than the military do. At least the military people have the continuity of being in the Army all their career and not in the Army and then back to some industrial firm or some university. I think we get more continuity of program by having it headed up by a general officer than we would have by having it headed by an Assistant Secretary.

Mr. McCormack. That is rather interesting testimony in view of what we received before. I respect your views on it.

Mr. Lipscomb. I want to ask a question about the technical services job again. Is there someone in each of these seven technical services at the same level as you are?

Dr. Power. Each of the technical services have a different organization, differing in detail. You will find in almost all of them, however, that the organization roughly resembles that in Ordnance. Ordnance's organization is such that we have a Chief of Ordnance who is responsible not only for research and development, but for procurement and field service. He then has Assistant Chiefs of Ordnance who have individual responsibilities for three major divisions: Field service, industrial, and research and development.

The Assistant Chief who has responsibility for research and development almost invariably has a civilian technical director, a scientific adviser who works directly with the technical service chief.

Mr. Lipscomb. Is the reason that you are here today because you are the best example of the technical staff and services branch?

Colonel Betts. I think you will have to ask General Uncles why we are here.

General Uncles. What was that?

Mr. Lipscomb. I was inquiring why Dr. Power was selected to come from Ordnance.

Dr. Power. Probably because we have 50 percent of the program.

General Uncles. We had little time but we wanted to bring a civilian scientist from a technical service. Dr. Power is one of the two or three in Washington.[1] Others are at Detrick or Edgewood Arsenal with the Chemical Corps or at Belvoir with the Engineers, and so forth. Also, Ordnance has the largest share of research and development funds.

Mr. Lipscomb. Are all the other six operated at the same level of efficiency as the Ordnance?

General Uncles. I see no marked difference in efficiency among the seven technical services. Each deals in a general field, and to my way of thinking they are all doing a first-rate job.

Mr. Lipscomb. On your chart again, and along with Mr. Balwan's question, how does your office get down to the technical services? Is logistics a roadblock in the organization?

General Uncles. If we issue a directive from my office it would go through G–4 and the deputy assistant chief of staff, G–4, to the technical services. But for informal coordination there is no barrier between us. I talk to General Simons or Dr. Power as freely as I do to people in my own staff.

Mr. LIPSCOMB. That is what this report is about. As long as there are people on the top who do this on an informal basis it is fine. But as soon as you get into a different personality it looks to me as though you have a possibility of a roadblock unless through the research and development you can go directly to the technical services and the universities on a coordinated research and development program, but in between here you have logistics who have a very small portion of the research and development activity in their office.

General UNCLES. I think under any organization as a representative of the Chief of Staff, as being in the Chief of Staff's office, I have full freedom to visit any subordinate activity or installation. I do not have to go through G–4, in other words, if I want to go to Aberdeen or if I want to go to General Simon's office or if he wants to come to mine.

Now, if there is action involved, a directive then has to through the normal organization channels.

Mr. LIPSCOMB. I can see where the special deputy would not have the same authority to bypass G–4 without some misunderstanding at some time in the future. The military services do not stand for insubordination.

Dr. VANCE. There has never been any difficulty.

Mr. LIPSCOMB. That is because we are working with good personalities, but we do not always have that same experience.

Mr. BALWAN. Do you still require continuing concurrence of the Assistant Chief of Staff, G–4, on any directions that you give to technical services?

Colonel BETTS. No. We do not get concurrence from G–4 but Mr. Lipscomb is right. When we want to direct Ordnance to do something, we do not write him a letter directly. We send it to the Assistant Chief of Staff, G–4. We are above the G's in the staff, so we would direct in the name of the Chief of Staff.

Mr. BALWAN. In the line of command?

Colonel BETTS. Yes, but there is an inherent delay in having to go to G–4, and G–4 having to tell the indicated technical services, but that is an organizational roadblock that so far has not proved to be particularly significant. We do have this specific agreement with G–4 that any time we want information we can go down to the technical services and ask them for it, unless there is going to be a great additional burden, in which case we might go through G–4 to acquaint him with the necessity for all this additional work.

Mr. MCCORMACK. Are you aware of the fact that the Rockefeller report recommended an Assistant Secretary of Defense, Research and Development?

Dr. VANCE. No.

Mr. MCCORMACK. Would that change your opinion about an Assistant Secretary of the Army?

Dr. VANCE. Probably not. I do not believe so.

Mr. MCCORMACK. I introduced a bill to that effect. As a matter of fact, I introduced one for the Assistant Secretary of Defense and I have been following this for about 4 or 5 years and I have been considerably disturbed and have taken it up with President Truman on a number of occasions.

Colonel BETTS. If the military can differ with the scientists I think if we have an Assistant Secretary of the Army for Research and

Development he could in many cases be a very effective individual in relationships with the Secretary and higher, but he would have to be the right kind of an individual and would have to be one willing to work with General Uncles in developing the program rather than one sitting there acting as though he were the chief of research and development immediately responsible for everytning in the program. If Dr. Killian were sitting in that position, I would like nothing better. We might have some excellent results. I can think of some people who might make it extremely difficult to operate.

Mr. McCormack. But if all the research and development generals were like General Uncles, I think he would get along very easily with an Assistant Secretary who is qualified because I know the general would.

Mr. Riehlman. Mr. McCormack, do you have any other questions on that phase?

Mr. McCormack. I think I made a little progress in the last few questions.

Mr. Riehlman. They now understand your interest. Did you have other questions, Mr. Balwan?

Mr. Balwan. Not on that point.

Mr. Riehlman. You may go on to the next question, Mr. Balwan.

Mr. Balwan. The third deficiency mentioned in the Davies report is as follows:

> The significance of research and development has not been fully recognized at each organizational level. Association of research and development in each technical service with procurement, production, and distribution has contributed to the integration of these activities. On the other hand, it has tended to subordinate this effort to these more dominating responsibilities. The imposition of procurement concepts of contracting, accounting, and related procedures have proven inimicable to the satisfactory accomplishment of research and development.

Mr. Chairman, on that point we have received testimony from several witnesses in the scientific world as well as in other service departments which have concurred in this statement of deficiency, of inadequacy of Army organization.

Colonel Betts. We certainly agree and admit that and I might cite a specific example of this to give you some understanding of what is involved.

In procurement regulations under which we let our contracts for research and development, it is required that we maintain property accountability of things which do not wear out or are not used up. In other words, no difference is made between the permanent supplies and equipment and expendable supplies.

On a procurement contract, where you know the contractor is out to make a profit, you keep a fairly close check on the equipment he buys and must at some stage return to the Government.

When we go to a university to ask them to perform research for the Army, it is usually found that they have good people but not the necessary equipment for the particular job. It is then necessary to supply funds from the research and development budget to help them get the equipment which will make the people effective on the research project.

Dr. Vance and I were in the office of Ordnance Research and asked the administrator what single problem they are most consistently faced with in dealing with universities in connection with research.

He pointed out that the major problem concerned the requirement for accountability of all property.

For example, they cited one of the property experts who came in to see some helium 3 which had been bought with Government money and was necessary to the experiment. Now, helium 3 being a colorless gas, this was absurd. It was in test tubes. The scientist said that it was in there. You could not see it. You had to take his word for it that there it was. If the glass broke and the gas was lost, certainly no routine means of property accountability would make any sense.

If the scientists build some piece of electronic gear for an experiment they are supposed to keep an accounting of every resistor and every tube that was bought with Government money, whereas in an industrial operation those things would be charged out from some stock account and the experiment as such would be billed for the overall cost of the item which is to be fabricated.

This type of procurement-property regulation is under review now in the Army and we have a representative on the committee reviewing it from the research and development organization. We hope to get eventually a separate set of procurement regulations which would permit us to contract for research under special regulations drawn for that purpose alone and not tied to procurement. It will be a major step forward, I am certain.

Mr. BALWAN. This recommendation does not envisage a separation of research from the other supply activities by putting research outside of the technical services.

Colonel BETTS. No; for this reason, that one of the most difficult jobs in the whole game is to get something out of research and to get it released to production. The further you separate the two the more difficult this job becomes so that the present organization in the Army strikes a compromise, or I will say the organization which we have recommended strikes a compromise. We put the production, the logistics half of it in one staff section and research and development in another. So that direction from the Chief of Staff would separate these 2 operations, would separate these 2 organizations. But down at the working level where the problem of coordination of the research and development with production is most difficult, there would be one head. In none of the technical services do they subordinate the research and development activity to the procurement activity. In other words, Dr. Power works under General Simon, who is the Chief of Research and Development for Ordnance and he has a clear and separate part of the picture, and no one in procurement or production has anything to say that will tell him he cannot run his program properly.

But General Simon must go out and let his research contracts under regulations that were drawn up for other things than research.

Mr. MCCORMACK. For example, what other things?

Colonel BETTS. You have the regulations governing the production and procurement of tanks, for buying spare parts, and so forth, which present a problem since these regulations do not apply to research. Such regulations do antagonize scientists because they show a lack of understanding of research.

Mr. RIEHLMAN. Do you have any further questions on this point, Mr. McCormack?

Mr. McCormack. No, sir.

Dr. Power. May I comment on the point of separating research and development in the technical services?

Mr. Balwan. I did not suggest it. I said "Does the method of correction envisage a separation?"

Dr. Power. When we established the Office of Ordnance Research we did this because we felt in order to carry out our basic research responsibility, a separate agency was needed which was concerned only with research.

At that time we gave the Office of Ordnance Research two options as to how they would go about getting the contracts negotiated; one, to do it themselves; or two, use the 13 existing ordnance districts. The reason we gave the option was because we were so afraid that the ordnance districts would be so concerned with the nuts and bolts that they would not know how to handle the research and development.

After experimenting about a year, the scientists down there decided that the districts could be educated much easier that the Office of Ordnance Research could establish its own contracting responsibility.

One of the most important factors in making that decision was that by utilizing the district contracting people they could reduce the overhead on the basic research program to only about 6 percent instead of 15 percent, which meant there was another 9 percent of our money we could put on contracts. So, as a result we have worked out a very effective arrangement with our districts, and as far as the procurement arrangements permit they handle research procurement in the way it should be used and not in the way desirable for nut and bolt procurement.

I would very definitely suggest it would be a bad idea to separate research and development from the technical services.

Mr. Riehlman. You may go on with the next question, Mr. Balwan.

Mr. Balwan. The fourth deficiency stated in the Davies report was:

> The Army's research and development organization has not attracted adequate support and interest from civilian scientists. The Army's deficiencies have impeded the establishment of a creative atmosphere, a climate hospitable to innovation and the stimuli needed for scientific work. These organizational lacks have been accompanied by attitudes which tended to encourage performance of research and development within Army installations rather than contracting with the country's scientific and industrial institutions through which, we believe, more effective results would be achieved.

General, do you want to comment on that?

General Uncles. I will ask Dr. Vance to comment on the first portion of that with respect to the creative atmosphere and the climate and the stimuli.

Mr. Balwan. First, we agree that this is a problem that they have stated.

Dr. Vance. I think everyone will agree that this is a problem and it will be a continuing problem.

In fact, this is the ordinary management problem. I do not believe for a minute that scientists are essentially different from other citizens.

The work they do is closely associated with the defense of the country and they are naturally—I do not think they are resistant to discipline because all their lives they have been in disciplines, but

they are resistant to dogma. At least they will inquire into the rights and wrongs of dogma. But I do not think this makes the problem essentially different from a management problem.

If I as a head of a chemistry department in a university attempt to exert a tight control over my faculty by stipulating which books they will use and what research problems they will do, I will immediately arouse a lot of opposition. But it is that kind of problem. I do not think it is a widespread problem. I think there are instances of it, and there may be instances in the future, I am sure there will be, which will be corrected, but the fact that the problem is recognized as it is means that it is going to be solved.

Mr. BALWAN. What specific recommendations or exercises have been initiated to overcome this beyond just the recognition that you speak of?

Dr. VANCE. Well, I think the thing that is done always is to choose the best qualified military man for each post.

Mr. MCCORMACK. One of the members of this committee was General Lemnitzer, Gen. L. L. Lemnitzer.

Another one was Mr. Irving A. Duffy. Do you know him?

Dr. VANCE. No.

Mr. MCCORMACK. Do you know of him?

Dr. VANCE. No.

Mr. MCCORMACK. Another member was C. Jared Ingersoll. Do you know him?

Dr. VANCE. Yes.

Mr. MCCORMACK. Another one was Harold Boeschenstein. Do you know him?

Dr. VANCE. I have met him.

I think the best way of influencing this is through the selection of the correct officer for the job. This is what it depends on.

Mr. MCCORMACK. Do you know what they meant by the Army's deficiencies, which have impeded the establishment of a creative atmosphere, a climate hosptiable to innovation and the stimuli needed for scientific work?

Dr. VANCE. I don't know what they had in mind. This strikes me as quite a general and broad statement.

Mr. MCCORMACK. That is true. I assume they had in mind probably an organizational setup. I would not assume they had any individual in mind.

Colonel BETTS. I think there is one thing which we look into constantly in the Army, and I do not doubt but what maybe industry would be faced with the same problem, and that is the tendency of what I would call the user, the soldier in the field, shall we say, to resent the scientist applying money to something which he sees no need for.

Mr. BALWAN. Who sees no need for?

Colonel BETTS. That the user sees no need for. We refer to this in our office as the requirement problem. There is nothing so discouraging to the scientists who come up with a new idea which is so revolutionary that it has not been studied by the field commander, to hear the field commander say, "I do not want any money applied to that development effort because I have stated no requirement for it."

In other words, if the scientist shows how he can build a new truck that will weigh only half as much as the present truck by the application of light-weight materials and which perhaps will not be able to carry quite as much in tonnage as the present vehicle in the Army, he is extremely resentful when his truck is not even considered by the user because the user says it will not carry 2½ tons across country, and therefore he is not interested in studying this revolutionary design which has been presented. The user says he has not stated a requirement for it.

This is a constant problem with research and development. It is a constant problem to keep people understanding that you must do a certain amount of research for the sake of research and you must do a certain amount of development in order to find out what one can accomplish. It is this understanding of research and development that will be the major contribution of a better personnel policy, keeping people in the game who have enough experience to understand the problem.

Mr. BALWAN. I don't know how satisfactory an answer that is, but——

Colonel BETTS. It is only a partial answer, but it is a constant problem.

Mr. BALWAN. It appears that as we have gone into these questions here, although this is a very important committee report dealing in part with research and development, that perhaps to get a better statement from the general on this, we ought to give them more time on it.

Mr. RIEHLMAN. Well, I think that the general will be furnished with the transcript of the hearings and he will have an opportunity to make any corrections or additions he would like to, and I think that will be helpful if he finds in reading over his answers to these criticisms in this report, particularly the four set forth, we would be appreciative if he will elaborate on them and give us any more information that he can.

General UNCLES. I will be glad to.

Mr. BALWAN. I think we can talk on the second part of that deficiency No. 4 which is that:

> These organizational lacks have been accompanied by attitudes which tended to encourage performance of research and development within Army installations rather than contracting with the country's scientific and industrial institutions through which, we believe, more effective results would be achieved.

Have you any idea what prompted them to say that when there is much more research being done by the Army than there has been, say, in the Air Force?

General UNCLES. I do not think there is any substantial difference among the services. We have been putting the pressure on ever since I have been in the business to have them do more contracting with industrial organizations and less in our own installations or our own laboratories down to a certain minimum point. We don't know exactly what that point is, but 25 percent or 35 percent of our program we feel should be done within our own laboratories to enable us to have people who understand what the rest of the world is doing.

Dr. VANCE. The figures for the entire Department of Defense are that about 67 percent of research and development funds are spent outside the services; and the figure for the Army is identical. I

think one figure is 67 percent and the other figure is 68 percent. So, two-thirds or more is done outside.

General UNCLES. I will give you a more comprehensive answer on that.

(More comprehensive answer supplied by General Uncles is as follows:)

Research and development, Army—Analysis by type of activity, "direct" costs

	Fiscal year 1954 estimated obligations		Fiscal year 1955 estimated obligations	
	Amount	Percent	Amount	Percent
1A. Facilities operated by the reporting bureau, technical service or command	$141,952	42.6	$155,617	44.0
1B. Other facilities of the Department reporting	1,364	.4	1,222	.3
1C. Other Department of Defense facilities	25,556	7.6	22,474	6.3
2. Facilities of other Government agencies	4,559	1.4	5,531	1.5
3. Industrial contractors	121,931	36.5	126,463	35.7
4. Universities and nonprofit institutions	38,124	11.5	42,693	12.2
5. Total, direct costs of research and development	333,486	-------	354,000	-------

Mr. LIPSCOMB. Do you have any trouble in having industry accept contracts for the Army?

General UNCLES. I know of no trouble that we have had with industry. Dr. Power is more familiar with the actual contracting in the individual industries.

Dr. POWER. On the contrary, we have to fight them off. We have no problem in getting any industry to work for us. I know of no industry that refuses to work for us.

Mr. BALWAN. You speak for the Ordnance Corps?

Dr. POWER. Yes.

Colonel BETTS. We have had problems. We made a considerable effort to get someone to take over the biological warfare work on contract. After finally finding someone to negotiate with us on this, he dug deeper into the problem involved and he decided it was not appropriate for outside contracting even though the chief of research and development and the Secretary of the Army had pushed to have it done by outside contracting. Before the Korean war when we did not have very much money in the research and development and some of our future funding was difficult, we had trouble getting industry at that time because industry was having a very strong expansion of its own. We had some trouble then getting people outside to take contracts.

Mr. LIPSCOMB. But did you say at the present time they are anxious?

Colonel BETTS. I do not feel that we have that trouble by and large. That specific field is the only one I know of.

Mr. RIEHLMAN. Do you have any more questions, Mr. McCormack?

Mr. MCCORMACK. On page 61 of the report of the Davies Committee they said:

> Two steps are required to strengthen leadership for research and development. The first is to reassign responsibilities for functional supervision of this activity from the Under Secretary to that Assistant Secretary who is assigned responsibility for materiel.

Apparently this committee had an idea about some assistant Secretary somewhere, didn't they?

Dr. VANCE. Oh, yes; I did not read that to mean he would devote all his time to research and development.

Mr. MCCORMACK. That is true, but on the other hand you can strike out "materiel" and put in "research and development." Not only today but projecting your mind into the future.

Dr. VANCE. One of them is assigned responsibility for research and development. Mr. Slezak now has that responsibility.

Mr. MCCORMACK. Yes; but this recommendation apparently is because he has too much work to do and to reassign the responsibility for functional supervision of this activity from the Under Secretary to that Assistant Secretary who is assigned responsibility for materiel. Under the new setup here, the logistics is not tied up with research and development, is that right, Colonel Betts?

Colonel BETTS. That is right.

Mr. MCCORMACK. And the material is more on the logistics side.

Colonel BETTS. Yes.

Mr. MCCORMACK. That relates to procurement and supply.

Colonel BETTS. Yes.

Mr. MCCORMACK. They cooperate together, but there is the recognition that they are two essentially important but different functions, basic research and the engineering in making it adaptable. I wish you would think that over, because I think it is far more important than just somebody in the job. I think it is far more important than that.

Mr. RIEHLMAN. Do you have any other questions on this point, Mr. Lipscomb?

Mr. LIPSCOMB. No questions.

Mr. RIEHLMAN. Do you have any other questions, Mr. Balwan?

Mr. BALWAN. Our time is getting short. I wonder how we should proceed from here on in. I have only one other question.

Mr. RIEHLMAN. That is on roles and missions. If we could develop that it would be very helpful for the committee and I know you have had some experience in that field.

General UNCLES. On the contrary, Mr. Chairman, roles and missions are outside of my province.

Mr. RIEHLMAN. I know that, but I think you have some ideas on it.

Mr. BALWAN. We will start the question this way; the guided missile program is primarily a research and development program except for certain missiles which are in production and it is still not outside of research and development because you keep up with that program.

Nevertheless, on any questions of overlapping in the research and development program they have to resolve among the three services. If you do not have an Assistant Secretary to resolve this or somebody on the Assistant Secretary level, who does it? How can you, from your office, settle on who shall handle ground to air missile research and development?

General UNCLES. Mr. Quarles, the Office of the Secretary of Defense coordinates research and development activities among the three departments, and I think he has already appeared before this committee. You will recall the coordinating committees that he no

doubt mentioned in various fields. He has a coordinating committee on guided missiles with Army, Navy, and Air Force representatives.

Mr. BALWAN. He is an Assistant Secretary of Defense for Research and Development only.

General UNCLES. That is right.

Mr. BALWAN. You say this is a problem that goes into roles and missions. He would say the same thing, that maybe roles and missions are not his field.

General UNCLES. I would say if he has any question as to which service should develop a particular missile he would refer that to the Joint Chiefs of Staff.

Mr. BALWAN. And your office is in Plans and Research?

General UNCLES. No. My immediate superior is General Lemnitzer, who is the Deputy Chief of Staff for Plans and Research, but my own function is research and development only, not plans.

Mr. BALWAN. Have there been any problems in settling on which guided missiles shall be researched and developed by the Army?

General UNCLES. None. I would say there had been no problems. There have been some questions which were resolved.

Mr. RIEHLMAN. Who was sitting in on this conference when these discussions were held?

General UNCLES. This coordinating committee meeting?

Mr. RIEHLMAN. Yes.

General UNCLES. The two members from the Army on this committee are General Simon of Ordnance and General Hertford, who is the Deputy Assistant Chief of Staff, G–4, for Research and Development.

Mr. BALWAN. How was Talos decided upon as to who should decide upon that particular guided missile?

* * * * * * *

Mr. BALWAN. Who in the Army presented that problem?

Dr. POWER. General Hertford and General Simon were the coordinating committee members. There was also Ordnance involved and General Hertford's representative.

Mr. BALWAN. This is research and development?

Colonel BETTS. Yes. They said that the Army ought to develop it if anybody did.

* * * * * * *

This was referred to the Joint Chiefs of Staff, who said that in their opinion this was an Army mission.

Mr. BALWAN. An Army mission?

Colonel BETTS. It came back to Mr. Quarles and his coordinating committee where the technical aspects of the problem—* * *—were worked out. * * *. I think a decision was made in all the proper channels, and the final decision as to what should be done in research and development was made by the Assistant Secretary of Defense for Research and Development. So, the machinery exists to iron out these things.

Mr. RIEHLMAN. Of course, it does prove that the research and development to some degree does enter into the roles and missions program.

Colonel BETTS. I would say that unquestionably the roles and missions assigned to a service must fundamentally determine the kind of work that they do in research and development.

If we in the Army went out to develop a 50,000-pound capacity fixed-wing aircraft we would be completely off base; this is not our responsibility.

Mr. RIEHLMAN. Do you have any other questions on that point, Mr. Balwan?

Mr. BALWAN. No, Mr. Chairman.

Mr. RIEHLMAN. Do you have any questions, Mr. Lipscomb?

Mr. LIPSCOMB. No questions.

Mr. RIEHLMAN. Do you have any further questions, Mr. McCormack, on this point?

Mr. MCCORMACK. No, Mr. Chairman.

Mr. RIEHLMAN. I would like to ask permission of the subcommittee to insert in the record the full statement that the general has furnished for the subcommittee, in which he covers many of the questions that were sent by the staff for him to answer.

With the permission of the rest of the subcommittee that will be made a part of the record at this point.

FURTHER STATEMENT OF MAJ. GEN. JOHN F. UNCLES, CHIEF OF RESEARCH AND DEVELOPMENT, DEPARTMENT OF THE ARMY

In order to be prepared to give adequate replies to various questions which may occur to you in the process of this discussion, I have brought with me my executive, Col. A. W. Betts; my deputy, the chief scientist of the Army, Dr. John E. Vance; and the chief scientist of the Office of the Chief of Ordnance, Dr. R. B. Power, Jr.

I should like to direct my first remarks to specific replies to the questions raised in your letter of June 1, 1954, with its enclosures. The first point for discussion is the scope of the Army's research and development program which, in general terms, has the mission of developing equipment and techniques to increase the effectiveness of the United States soldier in combat. In order to accomplish this, we have divided the Army program into major categories as indicated in the charts which have been furnished you. Most of the categories, that is, air defense, airborne landing; amphibious; supply and maintenance and materiel; atomic, biological, and chemical warfare; personnel, intelligence, and planning; land combat; materiel, components, and advanced research; AFF boards; and direct-support cost, are self-explanatory, but I feel that it is appropriate to discuss the nature of the effort that falls into each of them.

Under air defense, the effort is largely a matter of weapon development, as can be seen by a reference to chart No. 3, which analyzes the distribution of funds in this operational category. You will note that antiaircraft weapons, both gun types and surface-to-air guided missiles, with the detection and fire-control systems needed to make them effective, account for over 90 percent of the program in air defense, with the remaining effort directed to the achievement of an effective countermeasures capability.

The next category, airborne landing, amphibious and supply and maintenance operations, is broken down into three major subdivisions, as indicated in chart No. 4. The Army effort to achieve air transportability does not appear from this presentation to demand a large portion of our funds, but this is perhaps a failure of our administrative

system which labels as "airborne landing" only those projects which are directed primarily to the solution of airborne problems. The overall requirement that all possible effort be made to lighten equipment so that it may be air transportable is a requirement that cannot be measured in a dollar analysis and, consequently, is not indicated on this chart.

The next subdivision of this operational category, that of amphibious operation, accounts for a small Army effort in the development of amphibious equipment that is more truck than boat like the World War II DUKW. The major part of the program to achieve amphibious capability is carried in the Navy program by interservice agreement.

Under supply and maintenance, we find for a broad program to keep abreast of industrial developments; for example, if a new item of construction equipment is developed by industry, we would find in this category for personnel and testing facilities needed to make an adequate assessment of the effectiveness of this particular item of equipment.

On chart No. 5 you will find a breakdown of the program for atomic, biological and chemical warfare, each of which items are self-explanatory. In the biological and chemical warfare effort the Army, by agreement, accomplishes the bulk of this work for the entire Defense Department, with some additional funding support from the Navy and Air Force for development of specific end items of equipment required by those services. In atomic warfare the effort is directed primarily to the achievement of an atomic capability for Army weapons with a small program in medical defensive studies and radiological defense. This chart does not show, of course, the development of the nuclear components of atomic weapons since this is the responsibility of the Atomic Energy Commission.

The next chart shows the breakdown of funds between personnel operations, intelligence and planning, and psychological warfare. Under personnel operations, we fund for research in human relationships, which seeks to find means of making more effective use of our manpower. We also fund for the major part of the Surgeon General's program in military medicine and the Quartermaster General's program in the development of food and clothing. Under intelligence and planning, we fund for the development of equipment for use by intelligence forces and we include herein the Engineer Corps' program in mapping and surveying. The Army Operations Research Office is also funded in this category. The last breakdown, that of psychological and unconventional warfare, is self-explanatory.

The next chart on land-combat operations covers the largest dollar segment of the Army program. I believe that the breakdown to subcategories in this program is self-explanatory as far as indicating the scope of the Army research and development effort in this field. We can, of course, furnish more detailed information if you wish.

The last chart I have included, on materiel, components, and advanced research, is another very large dollar part of the Army program and can best be described as the necessity to maintain a strong supporting research effort from which will spring ideas that can be built into weapons or equipment of the future. The research in this category is the first step in the development of a new or im-

proved weapon. The breakdown into subcategories on the chart presented to you is provided merely to indicate the relative emphasis we place in each technical field.

You have asked the extent of coordination of the technical-services programs effected at the level of the Chief of Staff and the Secretary of the Army. I think this question can best be answered in conjunction with your request that I discuss the Army research and development organization, illustrating lines of responsibility and authority. To do this, I have presented a chart showing the Army's organization with indications by crosshatching of the places within this organization in which you will find elements of research and development.

If we start with the individual requirement for the development of a new item of equipment, or a new weapon, we find that it can appear in any one of the agencies indicated, it is most likely to appear in 1 of the 7 technical services if it represents new scientific effort or proposal, or in the Army Field Forces if it represents new thinking on the part of the user. There is nothing in our system which gives the responsibility for new ideas to any one element of the organization. Once this idea has been generated, it comes through appropriate channels to the level of the General Staff, where that element of the staff concerned with this problem gives it first consideration. For example, if it represented a new requirement established by Army Field Forces, G–3 (Operations) would give it first consideration and forward it to G–4 (Logistics) for comment, who, in turn, would probably request evaluation of this idea by the appropriate technical service.

If we assume that the technical service considers the idea to have merit from the technical point of view, it would probably be presented to a technical committee in this service on which every interested Army technical agency and the General Staff are represented. This is the most important point of coordination within the Army structure and within this committee we would work out internally the problem of whether or not this effort duplicates that of some other technical service, or, for that matter, of the Navy and Air Force since technical service personnel are generally familiar with what is going on in other services. Since the committee is made up of working level people familiar with the program in some detail, it is improbable that any significant duplication of effort would go undetected.

If the committee is in full agreement that this work should be undertaken, it would become an approved project and would be forwarded through appropriate channels to the Assistant Secretary of Defense for Research and Development. If the technical service that sponsored this effort had funds available to get the program underway there would be no further delay in its initiation. If funds were not available within that technical service, money could be made available by the Chief of Research and Development by adjustment of the program in some other technical service. If funds were not available from these sources, the project would probably have to wait until the next fiscal year in order to get underway. Of course there are means of getting emergency funds from the Secretary of Defense if the project is truly of an emergency nature, e. g., a scientific or technical break-through.

Now, every project in the Army's program comes under a periodic review by the Chief of Research and Development, who is in the Office of the Chief of Staff of the Army. I have available to help me in this review, the Army Research and Development Review Board,

made of general officers representing the Staff and Army Field Forces. At the time of this review, I am aware of the total money available to research and development and I have been furnished both the technical service and the General Staff recommendation as to the level to which each project should be funded for the coming year. Needless to say, this funding level is at best an estimate, since many things can happen during any given fiscal year to require an increase, or decrease, in the dollars committed to any particular project. The program is kept flexible by the authority to shift funds from item to item within certain limitations.

Upon completion of the review of the research and development program, the Chief of Research and Development presents his completed action to the Chief of Staff of the Army and to the Secretary, at which time changes can be made if directed; such changes to occur from time to time. Since the civilian special assistant to the Under Secretary for Research and Development sits as an observer during the hearings of the Army Research and Development Review Board, the Secretary's office is usually very well informed on the details of the program content. After approval of this review by the Secretary of the Army, this entire funding program by individual Research and Development projects is submitted to the Assistant Secretary of Defense for Research and Development for approval. His action through his coordinating committees, on which there is Army representation, has undoubtedly been discussed with you by Mr. Quarles.

You have asked whether there are any contemplated changes in the organization and administration of the Research and Development program. You are probably aware that some months ago, the Secretary of the Army appointed an advisory committee on Army organization, with Mr. Davies as chairman and with General Lemnitzer a member. This committee recommended that there be a strengthening of the Army research and development organization and this is currently under consideration. I do not know what the ultimate decision will be, but I am reasonably certain that some steps will be taken to increase the size of the staff directly responsible to me, obtaining this staff from the subdivisions of the staff I have previously pointed out on this chart. An additional recommendation of the committee was to the effect that the Army should make increased use of its scientific advisory panel. This panel has been in existence for something over a year and a half under the chairmanship of Dr. James R. Killian, president of the Massachusetts Institute of Technology.

It has been used to form special subcommittees to study specific problems given to it by the Secretary. It is now proposed that the panel be augmented and that arrangements be made for it to meet regularly at least twice a year. Since this panel is available for advise to both the Secretary and the Chief of Staff, I am sure that an increase in its use cannot help but improve on the effectiveness of the Army's research and development program.

The direct costs of the Army's research and development program for fiscal years '53, '54, and '55 have been graphically illustrated on the first of the charts presented to you which divides the costs into operational categories. The costs as prepared on this chart were made up for the submission of the Army fiscal year '55 budget request and have not as yet been corrected to reflect later information, such

as the probability that the requested $329.3 million will be decreased by $10 million by action of the House and Senate on the appropriation bill.

We have also presented in chart No. 2 the distribution to technical services of the total number of dollars requested for fiscal year '55, as well as the actual distribution of obligations in fiscal year '53 and the estimated distribution for fiscal year '54. On this second chart the dollar effort shown includes both direct and indirect support costs allocated to this program. These support costs are not, as a matter of operational procedure, broken out as separate funds for the operating development agencies. For this reason, they have not been shown separately on the chart in question; however, they have been shown as a separate cost in the first of the funding charts presented.

We do not pretend that the supporting costs shown here represent all of the dollar assistance given to the research and development program. These figures cover only such things as overhead, security guards, building maintenance, and similar supporting activities paid from the research and development appropriation.

In addition, we have figures available which illustrate the number of military personnel assigned to research and development in each of the developing agencies, and we know that there is some support given to research and development in other appropriations than research and development. For example, in certain of our installations, building maintenance is paid for by the Army commander through maintenance and operations appropriations. The estimated totals for 1953, 1954, and 1955 from the maintenance and operations appropriations are as follows: Fiscal year 1953, $18 million; fiscal year 1954, $13.9 million; and fiscal year 1955, $14.5 million. The numbers of military personnel assigned to this program are indicated in the first enclosure.

The present Army plan is to include in the budget project listed as direct support all of the dollars which we can identify as furnishing support to the research and development program not chargeable as direct costs so that we may have a better idea of just what this program is costing. This breakout of direct support was made in the budget this year for the first time and undoubtedly does not have as sound a basis as can be achieved as we get more experience in our effort to identify these costs.

Referring to the first enclosure in your letter, I wish to make specific reply to each question indicated.

Question No. 1: Are there any characteristics inherent in military organization which are incompatible with the administration of an effective program of scientific research and development?

Answer: There is no fundamental reason why a military organization cannot handle effectively the administration of scientific research and development. There is nothing in the requirements for military organization which so limits the organizational structure of a research and development laboratory that it cannot be responsive to research and development needs. I think this is most clearly illustrated in the organization of the Diamond Fuze Laboratory, which is an outgrowth of the VT fuse development program formerly carried on by the Bureau of Standards for the Army. I know of no scientist or responsible military person concerned with research and development who

has criticized in any way the effectiveness of the VT fuse development program as it was carried on by the Bureau of Standards.

I would like to point out that the transfer of that activity to the Army Ordnance Corps resulted in no significant reorientation of its effort and no loss of key scientific personnel that could be traced to the turnover of supervision to the Army. My staff discussed this matter with Dr. Hinman, who is the scientific director of this laboratory, and reported to me that the morale of the scientists is high and that Dr. Hinman is very well satisfied with the way the organization is now established and the scientific freedom given him in his direction of the research and development program.

Question No. 2: Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?

Answer: There is no reason why military supervision as such should retard the work of scientists or make it difficult to obtain and retain the services of highly qualified scientists; however, the fact that we are limited to civil service pay scales affects our ability to attract the best talent.

A little over a year ago, the Engineer Corps Research and Development Laboratory lost the services of Dr. Paul, an outstanding authority on infrared. Dr. Paul left without any evidence of dissatisfaction with the administration at the Engineer Research and Development Laboratory and has since cooperated very effectively as a consultant for that program. He stated on leaving that he just could not turn down the higher remuneration offered by industry.

It is certainly true that rules and regulations associated with the military do tend to create conditions unfavorable to scientists unless there is a strong effort at command levels to resist this tendency. A fundamental strength of military organization lies in the quality of its discipline. The average real scientist tends to resist dogmatic direction associated with military discipline. These two divergent tendencies can be controlled successfully by the assignment to command positions of the right caliber of officer who understands this distinction; this has certainly been illustrated by the successful transition of the Diamond Fuze Laboratory mentioned above where the military-scientist relationships are excellent. I do not pretend that we have always been this successful.

Question No. 3: Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?

Answer: It would be highly undesirable to divorce the military from the administration of the Army R. and D. program. Effective R. and D. must of necessity consider two major factors: the nature of the need and the state of the technical art. It is possible to find military officers with broad experience who have sufficient technical knowledge to assess the state of the art.

It is also possible for scientists with a full knowledge of the technology concerned to understand the military problem sufficiently well to determine the military need. On an overall basis, however, the scientist is more capable in his technical field and the military man is

more able to assess the military need. The most effective team to accomplish Army R. and D. must of necessity be made up of both military men and civilian scientists.

The balance between military and scientific personnel will vary from one program to another. If the two groups are separated, neither is responsive to the other and there is little mutual understanding. For example, in the medical program, many of our ablest investigators are in uniform because of the nature of their normal duties as doctors. In the field of ordnance some of our most effective experts in terminal ballistics, which is a measure of the importance of a weapon on the battlefield, are scientists. The balance will have to depend on the availability of competent people to do the jobs required to be done.

I believe that it should be kept in mind that the wartime need for the civilian NDRC and OSRD organizations arose from the low level of scientific participation in military research and development activities prior to World War II. One of the most valuable results of the work of the NDRC and OSRD was the establishment of a close and confident relationship between military men and scientists and engineers which has been continued since the war.

The organization of a separate civilian group at this time for the administration of the military research and development program would be a step backward. Our Canadian and British friends, both of whom have external civilian control of research and development, have expressed admiration for our system and their desire for a close working relationship such as we have between scientists and military men.

Question No. 4: Would it be feasible to organize military research and development programs in such a way that the technical activities capable of being performed by a civilian organization could be separated from those which are purely military, such as support functions? Where military support activities are necessary in connection with a research and development project, and such activities must be under a military commander, does it necessarily follow that the technical research and development functions must also be under direct military supervision?

Answer: Unquestionably, certain programs in R. and D. can use military support with a minimum of actual technical military participation. For example, in the engineering tests of a new weapon, military assistance in the form of jeep drivers, instrument readers, and weapon operators can be provided by personnel who have no particular need to understand the technical problems involved and, as a service to the operation, we frequently provide people of this nature. This type of a support function can be successfully divorced from the technical organization necessary to accomplish R. and D. having it available to be used as a tool when required. However, there is no reason why the necessity for providing such support should have any particular bearing on the basic organization provided to accomplish R. and D. The important point to remember is the need for an integrated team of military personnel working hand in glove with scientists to accomplish development of an overall system. This team can work just as well under a civilian scientist as it can under a military commander. For example, at the Army Operations Research

Office, the technical director is a civilian. At the engineer R. and D. laboratory, the commander is a military man.

Question No. 5: To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs? To what extent should private, nonprofit institutions participate? To what extent should private industry participate? How much "in-house" research is required for the military services to be capable of exercising qualitative control over research and development conducted by outside laboratories?

Answer: There is no magic percentage that can be tied to the need for contract effort with any organizations outside of the Army. However, the Army research and development program would fail of its mission if we ceased to contract for outside help. On items of essentially industrial nature, we should always contract for the development work involved, but at the same time we must have sufficient know-how in technical personnel within the Army to be sure that the contractor gives us our money's worth in the development program. At the opposite end of the scale, we find the basic research program is best carried on in university research laboratories, but again we must have inservice personnel with sufficient technical knowledge to guide this program, to insure that the results are made available for military use and to be sure that we do not contract for something that has already been accomplished by some other effort.

The extent to which we should contract with industry, private research organizations, and universities is determined best by the availability of the technical competence needed to solve our problems. We must maintain a strong hand at the top of the Army to prevent the building of large inservice empires. At the same time we cannot depend entirely on contract effort to accomplish Army research and development because we have had bitter experience in times of low defense budgets that many elements of industry refuse to take on research and development work for the Army unless they can be assured of a reasonable continuity of effort. I would say that in any program at least 20 percent should be conducted by inservice personnel to maintain a hard core of technical knowledge so that we may better assess the effectiveness of our contract effort.

In addition to these direct answers to your questions, I would like to make the general comment that the nine reported problems submitted as an enclosure to your June 1 letter have not appeared to be insurmountable problems in Army research and development laboratories, although it is certainly difficult to obtain and retain topflight personnel under Government salary limitations. Moreover, I feel that there are times when a military director has created a bad morale situation in an Army laboratory. However, I can provide statistics to show that although we are losing civilian scientists in certain instances, the losses are almost certainly due to our inability to meet salary competition. I am sure that each technical service is doing everything possible to select the right caliber of commanding officer for its research establishments to create the best possible atmosphere for carrying on the technical work.

It is true that as we rotate officers we lose continuity in direction to some extent, but there is a commensurate gain that is of considerable importance, which is that the rotating of military personnel

tends to keep a laboratory alive and prevent it from falling into a rut of its own making. I can assure you that I have the support of General Ridgway himself in the consideration that officers with research and development capabilities are kept in this program for as long a period as is commensurate with their maintaining a military capability. I would like to emphasize finally that the question of civilian-military relationships at research and development installations is always in our minds and that the best Army and scientific personnel are continually striving to make the relationship a secure basis for the success of our mission.

Research and development military personnel

Command	Fiscal year 1953	Fiscal year 1954	Fiscal year 1955	Command	Fiscal year 1953	Fiscal year 1954	Fiscal year 1955
Ordnance	2,392	2,392	2,204	Medical	289	398	398
Signal	1,098	1,114	1,114	Quartermaster	755	838	845
Chemical	1,484	1,252	856	Transportation	426	426	426
Engineers	259	263	263	AFF	1,751	1,867	1,809

Colonel BETTS. May I have these photographs back, Mr. Chairman, because they are classified, and the charts?

Mr. RIEHLMAN. Yes, sir.

May I repeat again, General, that you will be furnished a transcript of the hearings here today for an opportunity to correct them and any statements and changes that you would like to make in them. So, I want to express to you and the members of your staff our appreciation for coming over here this afternoon and giving the committee this information and if we feel in our deliberations at a future time that we need additional information we will get in touch with you.

Thank you very much.

General UNCLES. Thank you.

Mr. MCCORMACK. I might say, Mr. Chairman, that this has been a very enjoyable session and I join with the chairman in what he says.

I have been here 26 years in Congress and have been on many committees and sat in on many hearings and this has been one of the most pleasant I have sat in on.

Mr. LIPSCOMB. I would like to join in that, Mr. Chairman. I wish I had Mr. McCormack's experience.

Mr. RIEHLMAN. The committee will stand adjourned until tomorrow afternoon at 2:30. I am not certain in what room we will meet, but we hope we can meet here at that time.

(Whereupon, at 4:50 p. m., the subcommittee recessed, to reconvene at 2:30 p. m., Thursday, June 24, 1954.)

ORGANIZATION AND ADMINISTRATION OF THE MILITARY RESEARCH AND DEVELOPMENT PROGRAMS

THURSDAY, JUNE 24, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON MILITARY OPERATIONS OF THE
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met, pursuant to recess, at 2:20 p. m., in room G–53, the Capitol, Hon. R. Walter Riehlman (chairman of the subcommittee), presiding.

Present: Representatives R. Walter Riehlman, Glenard P. Lipscomb, Frank Ikard, and Bill Lantaff.

Also present: Representative John W. McCormack; Michael P. Balwan, staff director, and Carey Brewer, consultant to subcommittee.

Mr. RIEHLMAN. The subcommittee will please come to order.

I would like to have the record show the members who are present this afternoon, and also we are delighted to have here today Dr. O. G. Haywood, Jr., who is manager of Missile Systems Laboratory for Sylvania Electric Products, Inc., at Whitestone, N. Y.

Dr. Haywood, our subcommittee has been for some time studying this research and development program within the Department of Defense. We have known of your interest and your experience in that field in past years.

I just had presented to me this afternoon an article which you had written. I have not had the opportunity to read it, but surely will before we conclude these hearings, and write a report on this very important subject.

You have been informed, of course, and I think talked with our staff director, about this matter, and you have written a letter to us covering the points that we raised, and certain questions set forth in the letter; but, before we get to asking you to read portions of the letter and answer the questions, I think it would be very good to have on the record your educational background and your experience through the years up to the present position you are now holding.

STATEMENT OF DR. O. G. HAYWOOD, JR., MANAGER OF MISSILE SYSTEMS LABORATORY, SYLVANIA ELECTRIC PRODUCTS, INC., WHITESTONE, N. Y.

Dr. HAYWOOD. I will be glad to do so, sir.

Mr. RIEHLMAN. All right, fine.

Dr. HAYWOOD. Education: I attended the Military Academy, graduated in 1936, first in the class.

I had 2 years of river and harbor duty with the Corps of Engineers, and then the opportunity for graduate work in civil engineering at the Massachusetts Institute of Technology for 1 year.

NOTE.—Asterisks denote classified material deleted.

I was awarded a scholarship at Harvard, and the Chief of Engineers let me accept it.

After the year at Harvard I received a master's from Harvard and a doctorate from MIT in the summer of 1940.

I am a graduate of the Air War College in 1950.

My military experience: I served for 11 years in the Corps of Engineers, from second lieutenant to colonel, and then served from 1947 to 1953—this service was continuous—as a colonel in the Air Force; 17 years as an officer.

Assignments: I had about 4 years out of the States during the war, primarily in nontechnical work.

The technical background: I was assigned, when I got back from Europe in 1946, to General Groves' office of the Manhattan project. I was in his office responsible for the research program for the atomic project, and was loaned for a short time to the Atomic Energy Commission when they took over the activity.

I then served with the War Plans Division of the Army, and in 1947 transferred to the Air Force and served in the War Plans Division of the Air Force, in the staff in Washington, both of these positions being concerned with the use of atomic weapons in war and the preparation of some of our studies of what the military needed in the way of new weapons.

I then attended the War College, which I mentioned before as part of my education; was taken out of my course in midterm to go to Los Alamos in connection partly with the thermonuclear program and partly to serve just as a scientist—you might say as a military scientist in civilian clothes—in one of the divisions, the Weapons Division. I was there for a year and a half, and then was ordered to Baltimore to set up some activity to handle basic research for the Air Force.

I organized the Office of Scientific Research and headed that for 2 years, until I decided to resign from the service.

I resigned from the service and accepted a job with Sylvania Electric in their head office in New York City as manager of engineering planning last September, and after 5 months there they decided to set up a new laboratory and selected me to head up their new laboratory, which is handling an Army Ordnance classified contract.

My position now has already been read into the record. As manager of the Missile Systems Laboratory, I am responsible for organizing and heading the laboratory, to handle research, development, and evaluation of complex missile systems and all the components, with particular emphasis on the electronics.

I have written a few papers: Military Doctrine of Decision and the Von Neumann Theory of Games, published by the Rand Corp. in 1951, which shows that our military doctrine of decision can be handled with the mathematical theory developed by Von Neumann, and also that it is an extremely conservative doctrine.

There were other papers, one in the Journal of Engineering Education of March 1953 on The Air Research and Development Command Program, and finally one in the last issue of Air University Quarterly Review on Basic Research in the Air Force.

My service covered a number of things. I commanded a company, battalion, and was second in command of a regiment; served some time with Puerto Rican troops; also served in personnel work in the

States and overseas. I also spent about half of my military service in technical work.

Mr. BALWAN. May I proceed from that point?

Mr. RIEHLMAN. Yes, sir.

Mr. BALWAN. Could you tell us a little bit about what your position was with ARDC in Baltimore?

Dr. HAYWOOD. Yes. I reported directly to the Commanding General, sort of as an offshoot, not under the deputy commander, Chief of Staff or anyone else—a little unusual for a military organization—and handled the basic research program. By that, I mean, I set up an office of about 40 military and civilian personnel, including secretaries, everyone, to handle about a $5 million program of basic research.

As a matter of my pholosophy, we did no work ourselves. We contracted with universities for almost all of the work, and with industry for the remainder. The purpose was to support scientific work in advance of everything else the Air Force was doing, to give direction and long-range guidance to what the Air Force might get into that it was not then in.

Mr. BALWAN. Would it be all right to ask you the conditions which led you to resign from the service?

Dr. HAYWOOD. Certainly. They had nothing to do with my work in Baltimore, and, in fact, I put in my letter of resignation that I had fine support there from my immediate commander, and associates and it was extremely interesting work.

Mr. BALWAN. Dr. Haywood, before you go on, I think we could preface that question by the statement to the members: I have been very impressed by this man's training and his work in the service, and it looks like it is a shame and a great loss to the military to lose a man like this, and I think it would be helpful in our report to know why we are losing some people.

Up to this point, we have been concerned with losing people from the civilian side, but here we are losing what appears to be a very well trained person like you in the military.

Dr. HAYWOOD. Well, as you probably know, it has only been about 2 years in the last 14 that an officer could resign, a regular officer, and I feel that during this period of time there has been a very severe degradation of the status of officers.

Mr. BALWAN. Generally?

Dr. HAYWOOD. Generally. I fought it for a while from within, and then I felt it should be brought to public attention, and I resigned. I submitted my resignation at a time when they were not being accepted.

I also knew, indirectly, that I had already been recommended for promotion to general grade within the Air Force. It was not approved, I am sure, in Washington. It never got to Congress, but I know my own command had nominated me, and I knew that at the time; but as I said in my letter of resignation:

> As a senior officer, I must impose on able and patriotic subordinates conditions of second-class citizenship, conditions created largely by expediency, indifference, and discriminatory legislation. The degradation of military status must lead to decline in the quality of our military leadership and in the effectiveness of our Military Establishment. Continuance as a career officer constitutes tacit acceptance of this situation.

Then I documented it, and I would like to emphasize, I did not have any other employment at the time I submitted my resignation. I had no reason to believe it would be accepted. It was against the policy at the time, and also I felt it was sort of insincere to go out and find a better job and then put in a letter of this type. Since I intended to put in such a letter, I did so, before I sought other employment.

I might say I later had no difficulty finding a job.

Mr. LANTAFF. Could you expand on the points you mentioned there, that you have just read to us? Could you cite illustrations of what you meant?

Dr. HAYWOOD. If you care to, I could give you part of the letter.

Mr. BALWAN. No; just——

Mr. RIEHLMAN. I think what Mr. Lantaff has in mind is that you would explain a little what you mean in that paragraph and give us specific illustrations, if you could.

Dr. HAYWOOD. My next paragraph—and I started in the middle—reads:

> It is desired to emphasize that my objection is not to personal hardship but to status discrimination. During recent years all of the major advantages of military service have been reduced or eliminated.

Some of these have now been changed; this was at the time I wrote the letter—

> retirement for physical disability; voluntary retirement after 20 years' or 30 years' service; pay and allowances in terms of purchasing power; concurrent family travel; allowances for shipment of household goods; military housing; post exchange and commissary services; post recreational and social facilities, and dependent medical care.
>
> To cite one example, the pay and allowances of a major 15 years ago gave him a purchasing power not equaled today by the pay and allowances of a brigadier general.
>
> The deteriorated financial status of professional military personnel has lowered their civilian social status to an extent inimical to the well-being of their families.

I might interpolate here that a major general on flying status today has less take-home pay in dollars than he did 30 years ago—that is, in dollars, with no adjustment for the cost of living.

Mr. LANTAFF. Your reference to second-class citizens was a reference to the career officer in the service; is that correct?

Dr. HAYWOOD. That is correct.

Mr. LANTAFF. Yes.

Dr. HAYWOOD. Well, not entirely. I think to a considerable extent it is true of the enlisted man. It is true of the career man, officer or enlisted. I think it is one of the big reasons——

Mr. LANTAFF. Your reference there had no reference to the relationship of the scientific personnel vis-a-vis the other branches of the service?

Dr. HAYWOOD. No; not at all. I believe I was well used for my technical knowledge by the Air Force, perhaps better than I had been by the Army. However, I don't mean this entirely in criticism of the Army. For example, I was in personnel work for 2 years. I was the executive of the Personnel Division, War Department General Staff, at the end of the war. We had about 12 million people in the service then, so it was certainly a large enough job for anyone. I then had 9 years of service. But I was the only technical officer of all 50 who were making the War Department personnel policies for the entire

Army and Air Force. All the others were either Air Corps, Infantry, or Artillery, or something like that, and I was the only technical.

Now, I feel that that is a proper use of technical people, to have some representation in developing the overall policies, even though they are not using specifically their technical specialty.

Mr. LANTAFF. You think the career management system mitigates against maximum utilization of people with your background in scientific work in the Army?

Dr. HAYWOOD. I don't know that it is career management. In fact, I don't feel that I have ever had any career management, and I don't, personally, feel I want any. I prefer a little freedom to do my own career managing, and I have been fairly successful in the service in getting jobs that I thought were valuable, worthwhile jobs.

I think there is nothing worse than to be in a position which is not a challenge.

Mr. LANTAFF. Do you know of any officers in the service or regular officers who have been prohibited from following scientific pursuits or developing within the fields of scientific research and development because of career management?

Dr. HAYWOOD. Career management tends to affect the junior officers more than the senior who are handled more as individuals. I am certain that what you say is true, that there are people who would be better technically today if they had been permitted to stay longer in one or two jobs than they have. They have been moved too fast.

I know Dr. Schneider well. He works for me, and recently testified before you. He feels that rotation is a very serious problem. In my opinion, rotation is a very serious problem, only because we have so few technical people; that the objection is not that a new commander came in; it is that the old commander was so good, and the new one wasn't.

Now, I am sure no one told you about how glad they were when the rotation took a poor commander out and put a good one in. So, if we could rotate, replacing good commanders with good commanders, I don't think there would be a problem; and I think we would find out, if we looked at industry, there is a very substantial amount of moving there.

In my own case since leaving the Air Force, I had one job 5 months and then took on another one. The company certainly doesn't consider this as poor management.

Mr. LANTAFF. Mr. Chairman, I didn't mean to get into other fields here or ahead of other members.

Mr. RIEHLMAN. No.

Mr. LANTAFF. I was just interested in the implications of the sentences he had read to us.

Dr. HAYWOOD. May I say that paragraph starts off with this sentence:

After 22 years of military service—

I had some National Guard enlisted service before West Point—

I do not make this decision lightly. I have enjoyed my military duties and associations. In particular, I have had keen interest in organizing and heading the Air Force office of Scientific Research, and I have the deepest respect and admiration for my immediate superiors.

So, I certainly didn't feel that I was handicapped as a technical officer.

Mr. LANTAFF. In connection with the point, Mr. Chairman, as to why Colonel Haywood left the service, I would like to state I know from personal experience there are many more competent and qualified officers who are seriously considering leaving the service for the very same reasons that have just been set forth, and a good many of these reasons, unfortunately, are the fault of us in Congress who see a chance every once in a while to make whipping boys out of the armed services by using the economy ax, and there you have a group of people who find it difficult to fight back against it. But the morale of the career personnel, at least the junior officers in the grade, the field grade officers, is, in my opinion, at this time at the lowest ebb, and undoubtedly it has gone into the field of research and development, too.

Mr. BALWAN. Mr. Chairman, I think Dr. Haywood has a very good letter which talks about the problem we have before us, and if he could begin reading his answers to questions we have posed, I think we can formulate questions from that in a more precise way.

Mr. RIEHLMAN. All right.

Doctor, if you will proceed——

Mr. BALWAN. Unless you have other questions you want to ask him on this point.

Mr. RIEHLMAN. Do you have any other questions on this point before he goes into answering the questions the committee presented him?

All right, Doctor.

Dr. HAYWOOD (reading):

STATEMENT

This letter is submitted in connection with my oral testimony to be given before your subcommittee concerning research and development for the military services.

In my opinion, there are two essential requirements for a sound research and development program—competent management and stability.

The management group must possess those characteristics involved in the management of any large organization. In addition, management of objective research and development requires an exceptional ability to evaluate long-range objectives, to evaluate technical performance, and to make technical matters intelligible to laymen.

Research and development by its nature must be directed toward objectives often years in the future. There is a tendency toward making these goals too short, partly because short-range objectives are more easily visualized and partly because success seems more certain. More distant objectives require a bolder outlook but are more fruitful. In the Air Force, the pressure of operational and budgetary considerations tends toward emphasis on development projects for the near future and creates a condition which might be called that of premeditated emergency. While longer range needs may be recognized, initiation of work is delayed until the need has become so critical as to become an emergency.

Management must be able to judge the performance of subordinates.

Mr. MCCORMACK. Can you give any evidence in support of that last statement of yours?

Dr. HAYWOOD. In the last budget they deleted all basic research.

Mr. BALWAN. What budget are you talking about?

Dr. HAYWOOD. The budget——

Mr. BALWAN. 1955?

Dr. HAYWOOD. 1955.

Mr. BALWAN. 1955.

Dr. HAYWOOD. It would be the fiscal year 1955 budget for calendar year 1955–56. That is just a small example, basic research, $5 million out of a $15 billion budget.

Mr. BALWAN. You are talking about basic research in your shop, ARDC; is that right?

Dr. HAYWOOD. That is right.

Mr. BALWAN. Was there any other basic research being done besides what was supervising by you in Baltimore?

Dr. HAYWOOD. This gets into semantics of what is basic research. There is no basic research funded as such in the budget before the Congress now for the Air Force, to the best of my knowledge. This was done before I left the Air Force. I believe the program will be kept somewhat the same, but oriented toward shorter range objectives.

Mr. BALWAN. Could you explain what you mean by "basic research"?

Dr. HAYWOOD. By "basic research," I mean research when you don't know what you are going to do with the knowledge you are seeking, but you know that knowledge in this field would be useful.

Mr. BALWAN. Could you give an example?

Dr. HAYWOOD. I will give an example. We were supporting some work on the theory of turbulence. There is no way you can express in precise mathematics the flow of air over an airfoil. You can do it with digital computers and approximations, but the theory breaks down. We don't know exactly what we would do with an exact theory of turbulence; but if such a theory could be developed, there is no doubt in my mind there are many problems with the engines, with the propellers, with the airfoils, many places where we would use that knowledge, but there was no particular problem that made us support that work.

Now, to contrast basic research, you can have the blades in a turbine failing. You may analyze the problem and find the metal can't stand the temperature; then you spend a lot of money to find a metal which will withstand the requisite temperature. That is applied research. You know exactly what you are going to do with the knowledge you are seeking. You have got the problem right today, and if you don't solve it, you can't run the engine.

Mr. BALWAN. You are talking about a $5 million cut?

Dr. HAYWOOD. Well, they will do work. You just can't cut out this sort of research. There will be work in this general area.

Mr. BALWAN. Was this, your outfit, abolished in effect then?

Dr. HAYWOOD. It was put at a lower level after my resignation.

Mr. BALWAN. What can they do if they don't have an appropriation?

Dr. HAYWOOD. Well, they have money in the budget for applied research. They could try to get the theory of turbulence work oriented toward a particular problem, say, an aileron control problem, something like that.

Probably better examples exist. Just compare how much money goes into making an aircraft, buying more aircraft, or developing one new aircraft, compared with the little that goes into just pursuit of knowledge of aerodynamics which would help the designers later make even better aircraft. That is the type of thing I meant, the strong emphasis on what we need right now, even though if you sit back and

think a minute, you know what we are really doing is making a future crisis.

Mr. BALWAN. I interrupted Mr. Lantaff. I believe he had a question.

Mr. RIEHLMAN. Mr. Lantaff, did you have another question?

Mr. LANTAFF. The only question I had on that line was whether or not it might be possible that money was included in the fiscal year 1956 budget to be spent under contract for basic research.

Dr. HAYWOOD. All of ours were spent under contract. We contracted——

Mr. LANTAFF. You mean all that money was eliminated for fiscal 1956, all that would ordinarily be let out on contract, like the Rand Corp.?

Dr. HAYWOOD. Well, the Rand Corp. money is budgeted differently. As you know, budgets in the Government are sort of complicated. The Rand money is in there, as far as I know. It was when I left the Air Force.

Mr. LANTAFF. So, they could still be doing basic research at the Rand Corp.?

Dr. HAYWOOD. They really are doing operational research.

I make a distinction. Nobody in Rand will ever get a Nobel prize for what they do, whereas Theodorsen, with his theory of turbulence, might get it. In other words, it may be a real achievement in the advancement of man's knowledge.

Rand does very good work. I don't mean to criticize it, but it is analysis leading toward operational objectives, such as, how you should fly bomber raids against Russia; what would it mean to the Air Force if titanium would become workable or machinable; things like that.

Mr. RIEHLMAN. All right. Would you proceed with your statement?

Dr. HAYWOOD. I believe my next paragraph is:

> Management must be able to judge the performance of subordinates. Technical management is difficult because science and engineering tend toward specialization, and management personnel cannot be specialists in everything. Good scientists and good managers are rare. The combination of these talents is even rarer.

Mr. BALWAN. I think on that point there might be some question. Do you imply that it is difficult for the Air Force to get good managers?

Dr. HAYWOOD. Excuse me. Before I answer that, what I have prepared and have read thus far are, you might say, ground rules of the management functions, to serve as a basis for response to the questions formulated by your committee.

Mr. RIEHLMAN. Why don't you proceed and finish?

Mr. BALWAN. Go ahead.

Dr. HAYWOOD. I would like to answer the question. When talents are rare, you have to be sure that those people who have them are really used to their capacity.

To that extent, the military structure, the hierarchy structure, may mean you can't use a man to his full talents because he doesn't have the grade that the position would require. This is one of the problems.

I am sure you would find management of industrial research handled by younger men than in the military.

The next paragraph:

It is not enough that good work be done. Technical managers must maintain the confidence of their superiors and their customers. For military research and development these superiors are the Congress, and the customers are the combat commanders. Technology often develops a language of meaning only to specialists in the particular field. Management must bridge the gap between these specialists and the supporting and using public.

It will be noted that the foregoing characteristics are equally required for management of industry research. Unlike university research, which is often concerned with knowledge for knowledge's sake, military and industrial research must be evaluated on the basis of its pertinence to the organization's objectives, and be limited to projects with reasonable promise of success. There is probably no group in civilian life more qualified for key positions in military research and development organizations than those who have managed large industrial research organizations.

In addition to competent management, a research and development program requires stability of funds, of program objectives, and of personnel. There is a tendency to increase funds for military research in time of crisis, and to reverse this trend between periods of world tension. A program avoiding such fluctuations would be more efficient and economical for the taxpayer. This is an area in which Congress itself can contribute directly to the effectiveness of military research and development. Similarly, any action by the Congress to make technical careers more attractive, both for the military and civilian personnel would contribute to the personnel stability of the program.

Mr. BALWAN. Dr. Haywood, might it not also be proper to say "similarly any action by the Congress and the Defense Department to make technical careers more attractive"?

Dr. HAYWOOD. Certainly. I didn't mean to exclude what the military have authority now to do, and there is much that can be done.

Mr. RIEHLMAN. Could you give us a few illustrations of what you think the military could do to make it more attractive?

Dr. HAYWOOD. The path to advancement—there is no question about it—in all of the services is through operations.

If you have a Ph. D., and also have a pretty good knowledge of command, you will go further faster if you stick to command and just forget your Ph. D. In fact, I never told the War Department I had a doctorate until the war was over. When I got it, they didn't know I had. I wrote my doctor's thesis while I was a student at Harvard. They knew I was a student at Harvard. I went and enrolled in MIT on my own, took the exams, and was overseas before the degree list was published. My degree reached me in the mail in 1940. I just never told the War Department. I told them in 1946.

Now, this is an example. I felt it would hurt me as a commander, that I would tend to get into rear area, in supply or supervising somebody's contract, or something like that, which is all right as a senior officer; but as a junior officer in wartime, it would have hurt my career, I felt.

Now, I don't think there is anything wrong in my analysis. I point out that this is what I did in my case. I hid the fact I had a D. Sc. Now, I can see there are avenues open for pilots which are not open for nonpilots. This is obvious, but I, personally, feel that a pilot who is not a technical man has a better future than a pilot who is a technical man.

We have had 4 commanders of Air Research and Development Command, and they have been fine commanders, but 3 of them were operational commanders who rose through operational and not technical assignments.

General Partridge was a superb commander for the command. He came to the command from the Fifth Air Force in Korea. He didn't in any way grow up through the technical side, and there are very few people who do, who reach three-star rank coming up through the technical side.

Mr. BALWAN. Is General Putt a technical man?

Dr. HAYWOOD. General Putt is. He was the one of the four who was really a technical man.

Mr. BALWAN. Who is the present commander?

Dr. HAYWOOD. General Powers, who was General LeMay's No. 2 commander. He was deputy commander of the Strategic Air Command before he came to ARDC.

Mr. BALWAN. And is he a technical man?

Dr. HAYWOOD. He is not a technical man; no.

To be a little fair in here, there aren't too many technical men who make good commanders. This is true in civilian life. There aren't many good scientists who can run an organization.

So, they have to be handled—what I am saying is, they are rare birds and you have to handle them carefully, and they have to be handled specially, not under blanket regulations of 2 or 3 years in a job, or something like that.

Mr. BALWAN. What might be the answer to this dilemma we are faced with, careerwise, with these people?

Dr. HAYWOOD. One answer is, in my opinion, if we had a better understanding at the top of the organization of what we mean by technical people—what is the significance of technology in a future war

I saw somewhere recently that about 25 percent of the presidents of industrial concerns are engineers. Well, if you look at how many Secretaries we have, Secretaries of Army, Navy, Air Force, who are engineers, you find we tend, even on the civilian side, to put the engineers in specialties, handling such functions as research and development. Industry puts them into the big picture, too, because engineering is getting more and more important to war and to industry.

I think the services are behind here. The same is true in the military side. In addition to filling the top technical positions with technical officers (which we don't do now) we really should have some technical officers in the nontechnical positions. As I said, in my own experience, I feel I helped in personnel planning by being a technical man, to bring into policy determinations how the policy would affect technical people.

Mr. BALWAN. To develop Mr. Riehlman's question, are there any other problems in that area?

Dr. HAYWOOD. Well, it is a very severe problem, for which there is no easy answer, and it is true that many industries have not solved it, so that it is not simply that the military are behind. There are some industries way ahead of them—and these are all my opinions, of course—and some where the military are ahead of the industries. The difference is, in the industries it starts to show up in a few years in their profit-and-loss sheet, whereas in the military it is a danger to the Nation that may not show up until war.

Mr. LANTAFF. You wouldn't recommend the creation of a specialist corps with, say, a lieutenant general at the top of it, at the defense level, heading it up, would you?

Dr. HAYWOOD. I don't think any measure of organization can solve the problem whether it is a technical corps or, as I believe Schneider mentioned to you, the way the Royal Navy handles it, with a sort of civilian specialist corps, who are handled or assigned out within the military structure.

I don't think any correction can be made simply by organization. It has got to be from the point of, why don't we get really good people in the management, really good technical, competent management people in the management of military research and development?

Mr. MCCORMACK. Doesn't that come back to a matter of organization, then?

Dr. HAYWOOD. Not entirely, because if it were just a matter of organization, we could say, "They are already there; just being used improperly."

I am not sure we even have enough qualified people in the services now to run the program well.

Mr. MCCORMACK. Isn't it a matter of organization to produce them, to take advantage of the special talents of officers, to see they are trained in the line, along technical lines, to see that there is a continuity, as Congressman Lantaff indicated in his question, that where they are rotated, they are rotated to a related activity which is in furtherance of the technical field they are in?

An organization has got to be devised to produce that end result. That is what I mean by organization.

Dr. HAYWOOD. Yes, sir. In the Air Force now, research and development officers, that is, officers who have a research and development specialty on their record, cannot be assigned to other than research and development work without approval from high up in Washington.

So, in a sense, we have the specialist corps there, but not with any one looking out for them as individuals.

Mr. LANTAFF. That is right. There is no one to look out for them and to see that they are considered for promotion and that they have a chance to go up the general officer class and to progress within the general officer class; isn't that true?

Dr. HAYWOOD. That is true.

Mr. LANTAFF. If you had a separate corps, like the Corps of Engineers, say, defensewise, within the services, servicewise, with appropriate rank, so that there would be a chance for promotion within that scientific and specialist corps, do you think that would be the answer, or do you think those officers would tend to become too limited in scope and forget the operational problems that they should keep in mind in their research and development?

Dr. HAYWOOD. I do not believe it would be the answer, partly for the reason you mentioned, partly because the Navy did it with the engineer-duty-only officers, and I don't believe that has worked outstandingly well.

We had a specialist corps—of course, they were civilians brought in—and they were given commissions in the last war. That didn't work.

I think the problem is to recognize that it is an essential part of the service and not to be set aside as something peculiar; that we could have advancements now if there were a better appreciation, in my mind, at the very senior levels.

For example, the Chief of Staff devotes very little of his time, naturally, to research and development. It is a small part of his command, but he is also not trained for it. He is not a technical man.

Mr. LANTAFF. Of course, isn't it pretty true that is a problem that is always with us—in other words, unless you are now a paratrooper or airborne, and within a certain class of the Academy, you are not going to have much chance to get to be Chief of Staff?

Dr. HAYWOOD. That is right.

Mr. LANTAFF. So, the question revolves within the civilian leadership within the Defense Department, on the Secretaries, to say, "Look, just because Colonel Haywood has been in this scientific work for 9 years, it is not going to mean you are going to pass him over and put Joe Doakes in as major general; you're going to give him equal credit for his time in this work." Isn't that about the only way you are going to solve it, through a civilian Secretary of Defense exercising sufficient control over that?

Dr. HAYWOOD. I don't know. I won't go so far as to say it is the only way. I don't know how to solve it.

Mr. LANTAFF. That is one way.

Dr. HAYWOOD. It is going to take years to solve it. It is one way that would certainly give emphasis to it.

Mr. LANTAFF. If we have a solution, we are all right.

Mr. MCCORMACK. What?

Mr. LANTAFF. If we have a solution, we are better off than we are now.

Dr. HAYWOOD. We can look to a better example in the medical situation. I think it is equally serious. There we do set them aside. They are handled by a Surgeon General. They have separate promotion lists, and I don't think anyone would say they have satisfactory careers which are presently really attracting medical personnel into the service.

One time I proposed: Why don't you give every doctor a hundred dollars? If a medical man is worth something extra for saving a man's life in combat, how about those who design the equipment before they get to combat? You could recognize it with increased pay.

That would cause a little internal friction, but the medicos don't have a chance to get on top, to top command. So, they are set apart, and very likely a technical corps would be handled the same way, like the medical.

It would worry me, but I don't know—as I say, frankly, there are many things that can be done. Maybe a combination would be correct.

To return to my prepared statement:

> These comments constitute a basis for my response to the specific questions your committee has formulated.

And then I went through the five questions.

Mr. RIEHLMAN. All right. If you will proceed——

Mr. BALWAN. Before you go to that, you have talked about making technical careers more attractive, and stated in the preceding sentence:

> Similarly, any action by the Congress to make technical careers more attractive, both for the military and civilian personnel, would contribute to the personnel stability of the program.

Then we got off on how the military could make it more attractive. You haven't expanded on how Congress could make these more

attractive, as you suggest here. Would it be all right to interpose here, Mr. Chairman, and develop that point?

Mr. RIEHLMAN. Certainly, if he has any suggestions.

Mr. BALWAN. Would you want to do that?

Dr. HAYWOOD. Well, it costs money.

Mr. Talbott recently released some statistics. I think it was for the last 15 years, since 1929, the cost of living has gone up 200 percent; wages have gone up 315; and enlisted men's salaries have gone up 110 percent; officers' 60 percent.

Mr. MCCORMACK. And reenlistments have gone down from 60 to 30 percent.

Dr. HAYWOOD. Yes.

Mr. MCCORMACK. And if they can get them up to 80 percent—I read Secretary Talbott's speech he made recently. He figures with that continuity of career service, you could save the Government and the Air Force alone a billion and a half to two billion dollars, if we could have 80 percent reenlistments. They have reduced from 60 to 30 percent, and one of the main things is the economic problem, fringe and other things.

Mr. LANTAFF. Fringe benefits.

Mr. MCCORMACK. Hospital and medical, and so forth. I thought that made the very marked impression on me, coming from a man who knows what he is talking about.

Dr. HAYWOOD. There seems to be a hesitancy among the military people, since the generals make the presentations, to talk about themselves. The 60 percent for officers is average, and it is mainly junior officers.

As I already mentioned, the take-home pay of a major general, flying status, has gone down in 30 years. I would say the percentage pay of all generals may have gone up in the order of 10 percent since 1929 as compared with the cost-of-living increase of 200 percent. That is one thing.

Another one, there is a great deal of restrictions on authority, partly Congress, partly internal to the Defense Establishment.

There is no question that I have considerably more authority and freedom of action in Sylvania than I had in the service. We don't have the multitude of regulations. It is a vicious circle. Some restrictive regulation is written and someone abuses it. Instead of the man being court-martialed or criticized or being relieved from command, another more restrictive regulation is added, and pretty soon you have so many things prescribed in the book, the only way to get something done is to throw the book away, go ahead and do it and take your reprimand for breaking the regulations, but you get something done.

The more we try to prescribe actions of everybody, the less desirable you make it to serve in the organization. It becomes too difficult to accomplish anything.

Mr. LANTAFF. You destroy the initiative.

Dr. HAYWOOD. You destroy the initiative.

Mr. LANTAFF. Which is so necessary in this field.

Dr. HAYWOOD. Yes. Another one in the service, and it is a very difficult one, too. The centralized control of top promotions means it is based on the paper record and, so, the man with a nice, clear record, with no mistakes, is at an advantage over the one who has mistakes

and accomplishments. The tendency is to look to see there is nothing against him, rather than what has he actually done.

Mr. McCormack. In other words, if you do not go to bat you do not have a batting average. If you go to bat 10 times and get 3 hits you have a 300 batting average.

Dr. Haywood. That is true.

Mr. McCormack. But you have done something.

Mr. Lantaff. It is like the old saying, don't rock the boat.

Dr. Haywood. It certainly is. Another one is, look at the turtle. He makes progress only when he sticks his neck out.

Mr. McCormack. Those are hard questions. They are complicated. Of course, your military has pretty well got to be a regimented life, with discipline and obedience. Is that right? Pretty much?

Dr. Haywood. It is disciplined, but there is a great deal of freedom of action with troops in the field which you do not have in more stable situations in the States.

Mr. McCormack. Of course, I can understand that. Not as an officer—I was only an enlisted man so I have not had the value of commanding, but I can visualize it. However, you have two different groups here—the military and the scientists. They are both vitally important.

Now confining ourselves to research and development, there is no question in your mind, is there, Colonel, that research and development is a matter of primary importance in the world of today and the world of tomorrow? Is that right?

Dr. Haywood. I certainly agree.

Mr. McCormack. And while there are problems of human life in other branches of the service, in your problem here you have the military man whose life to a great extent is somewhat the opposite of the scientist. That is, in their way of thinking, and background, and life. One is subject to command and the other is searching for the discoverables of truth, as he sees them, and new discoveries. Is that correct in a broad way?

Dr. Haywood. In a broad way.

Mr. McCormack. Yes. The question is, what kind of a setup or organization can you have that will produce the greatest amount of teamwork between those two necessary groups, having in mind the results in connection with our national interest?

Dr. Haywood. I have the feeling that for the use of scientists to accomplish organization objectives, we can look to the pattern of industry. We have had a number of very outstanding university-type scientists in the Air Force program, I think there is a tendency for them to want the Air Force to do research the way universities do. To me the real parallel is industry, where you are working for a profit. The question there is: "Is this research going to lead to production, to something we can sell?" In the military we are not looking for profit in that sense. The research question is: "Is it going into production and going to make a good weapon?"

Du Pont spent millions on nylon. They did not know it was going to make silk stockings, but they knew if the thing worked and they made a new plastic there would be a use. In the same way the military can be quite visionary. They can get way back and say, "If we make a new explosive, or a new gun, or a new means of propul-

sion, there will be a use for it." I do not mean you have to have a definite weapon objective.

Like industry, we should look at the research and say, "Even if we do this it won't help us; it does not relate to any problem we have and so there is not much point in doing it with Air Force money." The National Science Foundation certainly could get into it for the culture of the Nation and also for the general scientific advancement of the Nation because people do not know what will come out. Nobody would have supported the Einstein theory of relativity on a practical basis, and I do not think the Air Force would if we were in the business today. But the National Science Foundation certainly might.

What I am leading up to is, there is some criticism of military research by civilians because it differs so much from academic research. To me this is not justified. The scientific advisory groups that advise our military services are proportionately overweighted on the academic side. There is a great deal of what they say that is true, but I think some of the criticism goes too far.

Mr. LANTAFF. Your statement would seem to furnish some support for eliminating the basic research from the defense programs and having your basic research performed by the National Science Foundation for all services, and thus eliminating duplication in basic research with the services, which is concerned with your applied research where the product will pay dividends.

Dr. HAYWOOD. I am convinced there is less duplication and less dollars wasted in the basic research programs of the three services than in any other part of their activities.

Mr. LANTAFF. Are you?

Dr. HAYWOOD. For one thing it is unclassified almost entirely, so that you do not have to have coordination by RDB committees. You have coordination in the field. Everybody knows what is going on.

A second thing is—and I used this before in regard to the Air Force program—nobody gets a Nobel prize for being second, and no professor wants to do something if he knows somebody else is already doing it and is ahead of him. He has no interest in it.

With an unclassified program duplication largely takes care of itself through the normal journals of the professions; the American Mathematics Society, and so forth. You know what is going on.

The other thing is, if we put all basic research into one agency, first of all I think it would be a mistake from the point of view of the Nation. It is too much power to give to Mr. Waterman and his staff. I do not think he would want it. In fact, I am convinced he would not want it—the power that if he makes a mistake there is no one else to correct it. There is no one else who can say, "Well, this might be used on something else."

In something as cheap dollarwise as basic research we can afford the luxury of a second review; and with the possibility of a real payoff in basic research in radically improved weapons, I think it is worth it.

The other point is, if you do not have some dollars to spend, it is hard to stay acquainted with the field. If the Air Force has only $5 million, they have got to have people aware of the scientific advances. They have to know what is going on and have got to go to the scientific meetings and appraise what they are supporting.

If we give them $5 million just to be acquainted with the field so that they could spend the $15 billion better, it would be worth it.

The best way to be acquainted with the field is to be working in the area and having some money with which you can support people. So even if we got nothing out of the program I am convinced it is worth it to the taxpayer in the sense of keeping the Air Force research and development program acquainted with the frontiers of science.

Mr. BALWAN. May that be a major weakness in our program today in research and development in all services, including the Air Forces?

Dr. HAYWOOD. I would go further than that. I think it is a weakness inherent in research and development. I am sure industry makes the same mistakes. They put money into making something and somebody else finds a better way, and it is worthless.

Mr. BALWAN. I mean, there is a great possibility that our qualitative control over our scientific programs is weak because we do not have the technically qualified people in the military to supervise the contracts that are being worked on. The contractors can give them a real snow job as to what is going on.

Dr. HAYWOOD. I believe that is true to some extent. I would say it is less true in the basic research area than anywhere else because the real sounding board there is the professional journals. For example, in the work in Baltimore we accepted in lieu of any final report—in other words, as justification for the payment of Government money—a manuscript which the scientist had submitted to a technical journal. The technical journals are a much better distribution than we can set up within the Government. They get out to the people who are really interested in the field.

If you are designing aircraft you read the professional literature on theoretical aerodynamics, and so forth. So it is getting to them.

The other thing is, if you make a mistake and support a man who is not competent and he does not know it and tries to get his work published, he and you find it out pretty quickly. If he does get it published he finds it out even faster by the criticism that comes in on his mistakes. You cannot do this in the classified area. That is one of the difficulties there.

Mr. BALWAN. Thank you. Now we can proceed.

Mr. RIEHLMAN. You may proceed with your statement.

Dr. HAYWOOD. On the specific questions, the first one is:

Are there any characteristics inherent in military organization which are incompatible with the administration of an effective program of scientific research and development?

My response is:

The incompatible characteristics are not inherent but stem from tradition. Civilian management at the Secretary level tends to be by successful businessmen. Top military management tends to be by successful combat commanders. To obtain research and development management by individuals who can manage such work effectively, it will be necessary either to decentralize authority to the level of technical competence or better yet to assign individuals with technical competence and point of view to top military and civilian positions. Engineers are well represented in top line and staff positions of industry. A similar representation in senior line and staff positions in the military services would strengthen the organization as a whole, as well as improve the conditions for military research and development.

Mr. BALWAN. The orientation of that question is to the civilian scientists. In other words, the thing we are thinking of is, are there

any characteristics inherent in the military which are incompatible with the administration of an effective program? What we are thinking of is, Is there anything in the program which prevents civilian scientists from putting out a good program?

Dr. HAYWOOD. Let me understand what you mean. You mean civilian scientists who are supported by Government funds put on to contract-supported establishments, or do you mean those actually employed by the Government?

Mr. BALWAN. Employed by the Government.

Mr. LANTAFF. Yes.

Mr. BALWAN. You see, the whole orientation of our hearings has been on the hypothesis that civilian scientists are leaving.

Dr. HAYWOOD. Yes.

Mr. BALWAN. The reason they are leaving is there are probably some characteristics inherent in the military organization which makes good scientific development impossible or difficult. Could you speak to that point?

Mr. MCCORMACK. Or, on the other hand, it is difficult to get good scientists. Either way.

Mr. BALWAN. Yes.

Dr. HAYWOOD. I think it certainly has point in two respects. One is at the management level. In other words, the people who formulate the program, civilian or military. And at the other, the actual working level of the people in Government laboratories who do scientific work. I would like to treat them separately.

In the first one there are very serious handicaps that I have already mentioned. But they are not because it is military. It is just because it is a big organization operating under regulations designed for other purposes. There is no reason why you could not have separate regulations for research and development work; but you don't. The budget review by detail is a severe handicap to preparing a good program, because the budget review after it leaves about the laboratory or research director level is by people who may be superb as administrators or as businessmen, but they do not know what the program means technically. So the tendency is on how well can you tie it or package it and make it look like some useful hardware purpose. This is a severe handicap. If the budget could be controlled by the men responsible for the work—in other words, if the people with the technical competence and really responsible for accomplishing the program were given the authority and then were held accountable not by detailed review of their program but by looking at their accomplishments, I think we could probably double the output for the same amount of money. It would be a coordinated program and coordinated by technical people.

Mr. BALWAN. I think we have to compliment you on the level of your thinking at this point, where you are thinking in terms of policy for the Secretary of Defense and the total research and development program. If we can put it at the level of your problems as the manager of an industrial laboratory and the problems you have which make conditions more attractive for the civilian scientists you hire as compared with the conditions that the same scientists experience in the military, that you are getting into your organization, such as Dr. Schneider and other people from special devices center, I think that is what we want. It is a different level from which to speak.

Dr. HAYWOOD. One, and there is no question about it, the civilian pay scale is higher for the top people.

Mr. BALWAN. How critical a factor is that?

Dr. HAYWOOD. I think it is quite critical. Pay is not everything, but there is a prestige that goes with pay too.

Mr. BALWAN. Dr. Schneider is making substantially more now than he did at Cambridge?

Dr. HAYWOOD. Yes.

Mr. BALWAN. However, was the increase in salary sufficient in itself to cause him to leave?

Dr. HAYWOOD. No; salary alone is not sufficient inducement. In addition you have benefits outside that you do not get inside. You have a very substantial life-insurance program paid by most companies these days. The fringe benefits which the services started years ago and which were far ahead of industry, are now way behind industry. The fringe benefits of the service are much better than the fringe benefits we give in civil service too. We do not consider they are entitled to fringe benefits. In fact, civil-service personnel cannot buy at the PX at most bases unless it is overseas or isolated, or something like that. It is just the regulation.

Another severe limitation—and I did not mean to put my answer at too high a level—is a man in a laboratory prepares a good program. It gets up to Washington and comes back with a quarter of it cut out. It makes no sense now. He is to make a three-legged chair. It gets annoying. He knows it was cut out because somebody along the line failed to show to a nontechnical man how it was all tied together. If it had come back to him, "Cut your program 25 percent," that would be different. He would do it and have a good program at a lesser level. But he puts his heart into making a balanced program and then must go ahead with it with vital portions deleted.

Another factor is the extreme fluctuations of the program. There is a tendency when money gets easy, like when a Korean war comes on, you have a large expansion of the research and development program. A few of the Air Force tried to fight it and said they didn't want a bigger program because once the crisis was over they would have a small one again. If we have a stable program we get a lot more out of it in the long run and don't waste the taxpayers' money. A number of technical people do not like the attitude that you must take the money and figure out a way to spend it. It is the exact reverse of what I have just mentioned.

At one time, they make a good program and it is whacked to pieces without evaluation of what it means technically. Then the reverse is true. They get 50 percent more money and are told to do something with it. I do not know whether you know it or not, but a little over a year ago the military budget for research and development was cut 25 percent, and 3 months later the money was given back. The program had to be cut when the funds were withheld. You can't go full-tilt on the money you have got and then run out in 9 months of the year. You have got to do something else. So the whole program was reviewed and tailored to a new level. Then you get more money back. So the ARDC replied to Washington that they did not want all of it.

They could put some of it back, but they couldn't effectively go back into the bigger program. Whatever finally happened I do not know.

This is very frustrating to any technical man, whether he is military or civilian. It is more frustrating to the civilians in that they are in the same job longer and are more wrapped up in solely the technical side.

Mr. BALWAN. What we are driving at is, we have people who are civilian scientists and have been in the military. Dr. Schneider is one of them. There have been other people who said there are a lot of annoying elements in military research. There are such petty annoyances as traffic regulations, and the fact that a chief scientist may not hold the equivalent rank—although he may be a Public Law 313 man and have the equivalent rank of a general. Still he is quartered in an enlisted man's quarters unless he has an officer with him who says he has this particular rank.

Are those conditions as real as they are brought out to us, or do you think it is something else?

Dr. HAYWOOD. They are very real. A great many of the military regulations are carryovers from the days when the military services were all military.

It seems quite logical to think of the military service regulations being for military people. You have the same problem not only with scientists, but with any civilians overseas in time of war. The operations analysts who went over flew in our combat aircraft, but for a long time there was a problem as to what happened to them if they were captured. We gave them an assimilated rank so that they could be treated as officers if they were shot down and captured. Otherwise they went to an enlisted prison camp.

By regulation and statute you cannot give civilians on military bases the privileges of the PX. They cannot buy at the commissary. The thought is, why should he? He is a civil-service man and employed in the area and does not have frequent changes of residence. He should be familiar with the local community and be able to purchase normally. The military facilities of this nature are because the military life is sort of a transient one.

Some civilians look at it the way I have just said, that they did not deserve it. Others look at it as a privilege of the military which they should be entitled to.

The question of being billeted comes up. It is true sometimes a civilian gets out and he is handled poorly by a base commander. That is what it amounts to. Not because he is a scientist, but because if you are at a SAC base you are not accustomed to a lot of civilians coming through. The tendency is to put them in the accommodations available, which may be enlisted accommodations.

Mr. BALWAN. That is the type of thing we are worried about, in the first statement. I think other members may have some questions on that type of thing.

Mr. RIEHLMAN. You are probably familiar with why Dr. Schneider left the service.

Dr. HAYWOOD. Yes, sir. I am.

Mr. RIEHLMAN. Do you have any other scientists that you know of who have left for the same reason Dr. Schneider left, and particularly while you were in the service?

Dr. HAYWOOD. The Cambridge Research Center case is a much more, shall I say, open—a much clearer case of a more open conflict between a group of the civilians and a regime of military than is normal.

Mr. RIEHLMAN. Do you think that is an isolated case?

Dr. HAYWOOD. I think that to the extent it developed there it is definitely an isolated case. I would like to point out that Dr. Schneider—I don't know what he said to you gentlemen, but I am sure he spoke highly of General Phillips.

Mr. BALWAN. Yes; he did.

Dr. HAYWOOD. I know both of them well. You could easily have taken Dr. Schneider's testimony a year ago and he might then be heartily in support of the military-civilian relationship existing at that time. It comes back to what I have tried to indicate at the beginning. It is people. It really does not matter whether they are in uniform or not. If the man is Phillips, whether he is a general or a doctor, and he understands management of research, he won't have trouble with either military or civilians and he will get a good job done.

Mr. MCCORMACK. Does that not come back to the training item, that is, to see they are trained to assume command positions? Obtaining technical knowledge is not something that takes place in a day or a year. True, you can be a technical administrator whether in uniform or not. You do not have to be a specialist; but you have to have some knowledge and some experience, don't you?

Dr. HAYWOOD. You certainly must have knowledge and understanding of scientific methods.

Mr. MCCORMACK. And if you are a specialist in one line it would be much more valuable. In other words, the rest of the technical men consider that.

Dr. HAYWOOD. That is correct.

Mr. MCCORMACK. And for the commander it plays an important part. In an organization where there is on a high level a civilian in command or in authority—not in command, but rather in the line of command—has that any importance?

Dr. HAYWOOD. You corrected yourself. I would leave it expressed as you first said it. I would have no objection in an organization to a civilian being in command.

Mr. MCCORMACK. I mean, of a laboratory.

Dr. HAYWOOD. Of any part of it.

Mr. MCCORMICK. You would not mean commanding troops, though?

Dr. HAYWOOD. No. Not command of troops.

Mr. MCCORMACK. No.

Dr. HAYWOOD. I would permit him to command troops engaged in technical work.

Mr. MCCORMACK. Yes; I understand. In a laboratory. They may be civilians or officers.

Dr. HAYWOOD. That is correct. In the office I set up at Baltimore I set up six technical divisions and went out to get the best men I could find for each. It ended up that 3 were headed by technical military people and 3 by civilians. I did not do this under any general plan of equal division between military and civilian. If I found a military man, fine, and if I found a better civilian, he took over.

Mr. MCCORMACK. Your testimony in that respect is right in line with General Phillips. The testimony in relation to General Phillips has been from all angles and he praised civilians.

Dr. HAYWOOD. I know General Phillips and I knew and was positive Dr. Schneider would speak favorably of him. That is why I

used the point there. It is not, as I said before, incompatible with the system for the military and civilians to work together.

Mr. RIEHLMAN. Just the act of dealing in personality and with people who are not alone qualified in a technical field, but understand human nature and are able to work with them and make adjustments where they are necessary.

Mr. MCCORMACK. In other words, if you find officers who have that technical background and experience, has it been your experience that the probabilities are that less friction would exist between the military and the scientist than in the case of an officer who has not had the technical background, or only a very limited one?

Dr. HAYWOOD. I would say that to have a good manager, a military man as a manager, he must have done some technical work. I would not say, however, that every man who has done technical work is going to get along well with civilians.

Mr. MCCORMACK. No. I am talking about the general proposition.

Dr. HAYWOOD. In other words, what you say is true. It may be that some civilians are hard to get along with—civilian scientists. And so are some military technical people.

Off the record for a moment.

Mr. RIEHLMAN. Off the record.

(Discussion off the record.)

Mr. BALWAN. I have a further question on this before you go on. I am not satisfied with your statement that it is not a characteristic that is inherent. I still believe that the chances of getting good leaders from military people are reduced to the extent that you do not have good military men. You expose yourself more to the chances of getting a poor man due to the rotation process; whereas, if you had a good civilian the chances are he may stay there 10 years and would have no reason to move. So that the military organization in that way produces a condition which is incompatible with good administration for an effective scientific research and development program to the extent that the rotation system does bring about a greater chance for bringing in a poor man, whereas with civilians it is not as true.

Dr. HAYWOOD. Is it not just as true that you have just as good a chance of bringing in a better man because the good man leaving is going somewhere else? Rotation, I think, can be a source of strength. The difficulty, I believe, is that the services do not have enough good technical people for all of the jobs requiring them.

Mr. BALWAN. But is there not a way of handling that? I agree with you this is probably not something inherent with the military organization, but with their regulations or policies for administering this. The thing I am driving at is that if we understand that we can get a poor man as well as a better man, that we might mitigate some of the bad effects if we put a civilian in charge.

Dr. HAYWOOD. If he is good.

Mr. BALWAN. If he is good. Of course, the opposite is true in that it is harder to get rid of a civilian civil-service man than it is a military man. But you might be able to mitigate some of the bad effects by getting more continuity through civilian personnel, who have more control over a program.

Dr. HAYWOOD. You would certainly get more continuity—and I don't mean when I talk of rotation to arge in favor of fast rotation.

I think in technical work 3 to 4 years is certainly a minimum. And anything shorter than that is possibly either wasting the man's time or hurting the organization.

If you look at what I have done, I am not speaking from my own experience. I have many short tours. Also looking at myself, I do not believe any of the civilians would talk of any serious friction with me.

May this be off the record?

(Discussion off the record.)

Mr. BALWAN. What is the purpose of rotation?

Mr. RIEHLMAN. Before you get into that, a statement was made by the doctor that intrigues me. You took this situation in hand and corrected it right there. You did not eliminate the position as they did at Cambridge, you suggested. Apparently your feeling is that the only reason why the gentleman who is in charge of that—the director, or assistant director in charge of research and development, whatever his title was—the only reason that the job was eliminated was to get rid of the man.

Dr. HAYWOOD. If I can go off the record again.

(Discussion off the record.)

Mr. LANTAFF. Is that not one of the defects of the rotation system in that whenever an officer is rotated into a command of this kind, the first thing he does is to pull out the organization charts to see how he can reorganize the laboratory? And is there not a great tendency to effect reorganizations within this field, which is disrupting to the work and upsetting to the scientists?

Dr. HAYWOOD. I feel that there is too much of a tendency to reorganize and that it is because people recognize it is not really running well. I feel when a commander takes over an outfit which has a reputation for running well, and is running well as far as he can see, that he does not make changes.

In my particular case I was there about 4 months before I did anything, and then it was just an individual or two.

Mr. LANTAFF. But is it not true that that is an inherent thing with the military system in that all you have to do is go over to the Pentagon and you will find out they are probably reorganizing some department over there right now. There is constantly and continually a reorganization going on because of new commanders coming in and wanting to change the setup.

Dr. HAYWOOD. Not entirely. We have realined some of our operations at Sylvania several times since I have been there, and I think it strengthened the organization. We have reorganized to match changing purposes.

Mr. LANTAFF. Is there not a tendency to reorganize based on the whim of a commander rather than to achieve the purposes that you have sought at Sylvania?

Dr. HAYWOOD. The commander has the authority to do it, and if he has the whim he can. I think it is overemphasized by a number of people, and I personally think the number of reorganizations in the research and development field is because it is not working well.

Mr. LANTAFF. And by reorganization you actually tend to disrupt the thinking of the scientists and it is always costly in terms of just physically moving desks from one side of a shop to the other side and working through a new chain of command, and so forth.

Dr. HAYWOOD. That is right.

Mr. LANTAFF. I have sort of gathered from the testimony that that was certainly the tendency that was coming about from the rotation system. Every commander wants to clean it up by reorganizing, whereas the difficulty is more basic than that.

Dr. HAYWOOD. I agree with you fully that the tendency is to reorganize to correct defects more basic than that. I think you have touched the thing exactly.

Mr. RIEHLMAN. I wonder about this, Doctor. I am thoroughly interested in your remark about that Cambridge situation. You asked to go off the record. My question is on the record. I wonder if you would read it back, Mr. Reporter?

(Whereupon the question was read by the reporter as follows:)

Mr. RIEHLMAN. Before you get into that, a statement was made by the doctor that intrigues me. You took this situation in hand and corrected it right there. You did not eliminate the position as they did at Cambridge, you suggested. Apparently your feeling is that the only reason why the gentleman who is in charge of that—the director, or assistant director in charge of research and development, whatever his title was—the only reason that the job was eliminated was to get rid of the man.

Dr. HAYWOOD. All of the events at Cambridge took place after I left the Air Force. I know nothing about them that is personal knowledge. I know the Cambridge situation previously, and I have some hearsay evidence of what happened afterward. I am not a confidant of General Maud as to why he eliminated the position.

Mr. RIEHLMAN. Following the illustration you gave in respect to the manner in which you handled a similar situation, you would not have eliminated the position to get rid of the person?

Dr. HAYWOOD. I would certainly not eliminate a position to get rid of a person.

Mr. MCCORMACK. I would like to get at this without mentioning names because we have kept away from personalities since we are interested in something more farreaching than that and are only interested in the personal happenings in that they might contribute toward our thought as to how we might act on the evidence we received, in the making of recommendations that we hope and we feel would be constructive. Your knowledge of the situation up there in relation to the individual you mentioned off the record, is mainly hearsay.

Dr. HAYWOOD. No; I am acquainted with the individual from my personal knowledge and official working relationships with him in my Baltimore work. I was in the headquarters of the command of which Cambridge was a subordinate center.

Mr. MCCORMACK. You have a high regard for General Phillips?

Dr. HAYWOOD. I have a high regard for General Phillips. Yes, sir.

Mr. MCCORMACK. For your information, he has testified very highly about the particular individual.

Dr. HAYWOOD. I am not surprised.

Mr. MCCORMACK. You have a high regard for Dr. Schneider?

Dr. HAYWOOD. I have a high regard for Dr. Schneider.

Mr. MCCORMACK. And he testified very highly. Do you know, would you as a commanding officer go over the head of your deputy civilian and talk on matters that were within his jurisdiction, with those underneath him, and then come back without consulting him and issue orders to him? To your civilian deputy?

Dr. HAYWOOD. I have never run an organization, including troops, in which I couldn't talk to anybody.

Mr. MCCORMACK. That is all right.

Dr. HAYWOOD. I feel that you must have informal relations with all of the people. Normally I would issue instructions through channels.

But I also consider that a commander can do otherwise; that the subordinate and not the superior has the responsibility of keeping intermediate commanders informed of what instructions he may receive out of channels.

I do not believe that every action should be taken through the chain of command.

Mr. MCCORMACK. We can all understand that, because just like here we are asking questions and there is no line of command based on seniority here, or anything else. But you would certainly consult with your civilian deputy?

Dr. HAYWOOD. Certainly.

Mr. MCCORMACK. You would not bypass him completely?

Dr. HAYWOOD. No. Not at all. I misunderstood that part.

Mr. MCCORMACK. You would not have a meeting of employees in lower echelons at either your home or their home without advising the director or your civilian deputy of what information you heard or obtained, would you?

Dr. HAYWOOD. No. I would certainly not do that, and in addition, if I knew the meeting was coming up I would certainly invite him to be present.

Mr. MCCORMACK. Did you know that even in the case of Dr. Schneider the commanding officer, we have evidence, even went below him and did not consult Dr. Schneider at any time or let him know what he heard in the nature of complaints or otherwise? Were you aware of that fact?

Dr. HAYWOOD. No. I have never made any study of the Cambridge situation at all.

Mr. MCCORMACK. That would not be consistent with any kind of organization, either military or otherwise?

Dr. HAYWOOD. I would not go so far. I would suspect—and it is entirely speculation—that if General Phillips had done the same thing there would probably be no friction because of that incident between Dr. Schneider and himself.

Mr. MCCORMACK. Not an incident—incidents; plural.

Dr. HAYWOOD. I am not informed on the subject. I was talking about only one aspect of the situation in which I indicated my view of an individual.

Mr. MCCORMACK. Suppose I am your civilian deputy. As a result of talks with others who are my subordinates in a position to obtain certain information, which is perfectly all right, that you issue orders to me without letting me know what you heard. Would you think that would be a course of conduct that you would take?

Dr. HAYWOOD. Here again it would depend on the nature of it.

Mr. MCCORMACK. You are answering that question to all of us who have had in our own journeys through life command positions in our own journey in life—not in uniform, but in command positions outside of uniform. In other words, in my little office I would not go over the head of my administrative assistant. If anyone came in

and told me something about him I would call him in and say, "Say it in his presence."

Dr. HAYWOOD. I missed the point of the conversation. I didn't realize that the subordinate was criticizing his boss, and that that was the situation. I thought this was a situation where he disapproved or approved a project, or something of that nature, without the more senior man being involved. I misunderstood.

I think here you get into one of the ticklish parts of any big organizational setup. You do not want to encourage malicious gossip. At the same time, if you are going to act on it the man is entitled to know what you believe to be the fact. It may not be the fact.

I did not realize you were talking about a situation of either personality clashes, or gossip, or alleged incidents upon which you base an action which affects an individual without him ever having the chance to know why you were doing it.

Mr. MCCORMACK. If I were at a laboratory for 8 or 10 years during which there were 10 or 12 different commanding officers coming and going, and I got along with all of them but one, that would be rather pretty good evidence in my favor that I was able to live with them. Say there were 12 and I was able to get along there with 11 of them.

Dr. HAYWOOD. It is good evidence all right.

Mr. MCCORMACK. I will not press it any further.

Mr. LANTAFF. Will the gentleman yield?

Mr. MCCORMACK. Yes.

Mr. LANTAFF. You draw a distinction between this consultation with your deputy in connection with the approval or disapproval of the project. By that I do not understand you to imply that you would approve or disapprove a project by relating your disapproval or approval to some subordinate of your deputy without at least letting your deputy know about it so he would not be left out in the cold.

Dr. HAYWOOD. People have different ways of running organizations. I have a way I like and I did it in Baltimore, and I am doing it in Sylvania. Dr. Schneider is my principal subordinate, and under us there are managers of each of the departments. They are all authorized to take actions which they feel are proper and affect only their responsibility. The next day a reading file of all letters that leave the office is circulated to all of us. It includes my own. I see their letters; they see all of the actions I have taken. In this way there is a feedback. If I do not like what is done, and it is a serious matter, I can always pick up the phone and reach the addressee before the letter gets to him. I ran my Baltimore military office the same way. I did not always consult my subordinates, but they knew about all my official actions.

Mr. LANTAFF. He knows about it.

Dr. HAYWOOD. Actually, everybody in the office can know about it. There are glass windows. I was a public administrator and certainly my own people ought to know what I was doing.

Of course, it has the other advantage that you quickly establish a tone of correspondence and a tone of the office.

Mr. LANTAFF. That type of organization is indicative of good leadership and it is so designed that you do not circumvent your deputy, because if you take direct action with the department head your deputy is nevertheless in a position to know about it and is not left out in the cold where he feels he is being circumvented.

Dr. HAYWOOD. Right. I may find out I have made a mistake and he knew something I did not know. Of course, if I had thought I was wrong I would talk to him first.

Mr. MCCORMACK. Will the gentleman yield?

Mr. LANTAFF. Yes.

Mr. MCCORMACK. When you called in the deputy after 4 months and had a conversation with him and he got another position, did thereafter other scientists or directors resign shortly thereafter?

Dr. HAYWOOD. No, they congratulated me. Incidentally, this individual and I are still good friends. I know him well. I know his wife; and he is doing a good job now. He was just in the wrong job. He would probably have gone on longer in it, but he recognized it after our conversation and in fact made the statement before he left that he felt he learned more in the 4 months with me of management than he had any time before in his life.

As I say, we are friends. But my point was that we did it openly and each understood the other.

Mr. MCCORMACK. But there were no other resignations?

Dr. HAYWOOD. No others.

Mr. MCCORMACK. There were at Cambridge.

Dr. HAYWOOD. Yes; I know.

Mr. LANTAFF. Have you finished?

Mr. MCCORMACK. Yes.

Mr. LANTAFF. The witness has indicated a personal knowledge of the scientist we are talking about. Do you think either on or off the record it would be beneficial to have his evaluation?

Mr. RIEHLMAN. Well, if the committee so desires I would prefer to finish these questions. There are 2 or 3 more. Then if he would give it off the record I think he would probably rather do that than have it on the record.

Dr. HAYWOOD. I would much prefer it off the record.

Mr. RIEHLMAN. Yes. We would not want to force you to make any comment on the record unless you want to.

I would suggest if you have no more questions on this first question here, as soon as we finish with the doctor on these questions and answers then we can go off the record and ask him to give us his opinion.

Dr. HAYWOOD. By "record" you mean the public record? I do not care at all about on or off the record during an executive session.

Mr. RIEHLMAN. This is an executive session. I want to tell you this, Doctor. You will be furnished a transcript of this hearing at which time you will be permitted to delete or mark, if you would like, any portion that you would like deleted from a public record if and when the committee desires to make it public.

Mr. MCCORMACK. Or you can elaborate on it.

Mr. RIEHLMAN. Or elaborate.

Mr. MCCORMACK. Or suggest anything further that you think might be helpful.

Mr. RIEHLMAN. Yes. All right. Suppose we go to the next question, Doctor.

Dr. HAYWOOD. On the next three questions, I took them as one. The question of whether a military organization tended to create conditions which retard work, and whether it would be desirable to

establish a civilian organization, and how would you have necessary military participation separated from civilian, such as between technical and support functions. I answered those together.

Mr. RIEHLMAN. All right.

Dr. HAYWOOD (reading):

With respect to these three questions no arbitrary conclusions are possible regarding the details of organizations. The three services handle research and development quite differently. Other nations have set up research and development organizations which place civilians in positions of more authority than do the United States military services. There seems no question that many types of organizations may function efficiently in the field of military research and development.

The military research and development organization must have a sufficiently military point of view and knowledge of war to insure direction toward weapons of future combat usefulness. The Ministry of Supply which supports the British Army and Air Force includes many active-duty military officers. Our own National Advisory Committee for Aeronautics is a civilian organization but certainly has maintained sufficient military contacts to support effectively military aeronautics. As technology becomes more and more integrated with military operations, it may become true that it will be easier to educate scientists and engineers into military strategy than to educate military strategists into science and engineering. In any case a partnership using both military and civilian personnel is essential.

Technical careers must be made more attractive both for military and civilian personnel. Your committee has questioned a number of civilian scientists who have recently left military research organizations. A similar exodus has occurred of senior military personnel experienced in research and development. For both classes of personnel, the last few years have seen a marked decrease in career attractiveness with respect to salary, emoluments, and prestige, and a sharp increase of unwarranted criticism.

It is my opinion that military research and development can be directed effectively from within the military structure and that the organization concept of the Air Research and Development Command is exceptionally sound. The concept was developed by the Ridenour committee of individuals experienced in military, industrial, and university research. Certain needless impediments have been placed in the path of the ARDC; for example, a good deal of ARDC technical procurement is handled by another command operating under procurement policies ill designed for research and development. Finally, the declining career attractiveness of the last few years has had a more immediate impact on technical organizations. A pilot who has done nothing but fly aircraft for 20 years is not prepared for another career. A technical man, military or civilian, can transfer with little difficulty to industry.

The final question is:

To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs? To what extent should private, nonprofit institutions participate? To what extent should private industry participate? How much in-house research is required for the military services to be capable of exercising qualitative control over research and development conducted by outside laboratories?

It is my view that the most effective military research and development organization can be developed along the pattern established by General Groves for the atomic-energy work and continued by the Atomic Energy Commission, i. e., contracting with universities and industry for management of large-scale technical operations. In the atomic-energy field non-Government institutions participate in developing the long-range objectives as well as in performance of the work. The question of proprietary interest would be a much more serious one for research and development with commercial counterparts, such as for the Air Force instead of in the atomic field. However, the AEC experience has demonstrated the efficiency that can be obtained with use of non-Government institutions for management as weill as accomplishment of technical tasks.

Such an organization would require no in-house research. Government personnel could be assigned to non-Government operations for training, just as military personnel are now assigned to AEC contractors.

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The same way as I worked at Los Alamos.

Mr. BALWAN. Do you not think there is too much in-house research in the Air Force?

Dr. HAYWOOD. No. What I am basically saying is—well, it is a whole change of philosophy. If you take the objective of General Groves, where something like 95 percent of the people engaged in the project are employed by contractors and not the Government itself, it gives to the Government—military and civilian—the primary function of determining the operational objectives; the procurement and legal functions, that the work meets the requirements that the Congress and the regulations impose; and the inspection of performance. But it does not get the Government itself involved in detailed research and development, and production, and so forth.

Now in order to have the competence for these big jobs—and in effect it gives the Government the big jobs with real direction—in order to have the competence to do it your young people will certainly have to get their hands dirty. But they can do that in the same way we send young officers to civilian schools to study, and we send young officers in some cases to laboratories of the Air Force, or Navy, and so forth. When it comes time for these people to get real training, to produce something and write a few technical papers, they can do that at a contractor's installation.

Mr. BALWAN. But is that not a confession of a weakness in a military organization when you say that we ought to do more of it through nongovernmental institutions? Just what are the difficulties which make it not possible to do that kind of work in a military organization?

Dr. HAYWOOD. The Atomic Energy Commission is entirely civilian, and they do it. So I am not saying it is a weakness of military organizations. You might say it is a weakness of Government organizations, and I would agree with that.

Mr. LANTAFF. You mention, one, your military regulations which are designed for military control rather than control of military research, and so forth; and second, your budgetary problems within the service. By a contract with nongovernmental institutions you eliminate those two problems that are within the service and you also accomplish getting the higher pay for the scientists, although you are going to pay more for it. But you are doing it through contracts and perhaps paying them higher salaries. Then the renewal of that contract is based on the results obtained in the performance, which is a test we do not apply to our military operation.

Dr. HAYWOOD. I would agree with you fully, with one slight exception, that you pay more for it. I am convinced you pay individuals more and get the work done for less.

Mr. LANTAFF. That is fine. If that can be done.

Mr. BALWAN. In addition, you have the other statement in which you say you eliminate needless impediments with respect to procurement of research and development materials.

Dr. HAYWOOD. The impediment I meant is one where the Air Materiel Command handles two-thirds of the contracting and actual writing of contracts for the ARDC. This never made sense to me. What my proposal amounts to in the way of procurement is: when you go to the AEC type of operation, you write big contracts instead

of lots of little ones; or you hire big organizations of people instead of individuals.

The Los Alamos contract given to the University of California is a lot of money. That goes to them as their fiscal year appropriation. Los Alamos submits a technical program for atomic research for the year prepared by the contractor. But, of course, Los Alamos is sort of a wholly owned subsidiary of the Government. They have lots of conversations. They know what the Government wants. They have military people working in the laboratory. They have liaison at all levels. The military liaison committee reports directly to the Secretary of Defense. They certainly have the information they need to keep their program of value to the defense of the country. But there is a flexibility in it that you do not have with a number of separate contracts. If you gave 10 laboratories within the Government the atomic program, or if you gave 10 outside institutions separate parts of it, you would make it much more difficult to suddenly change the direction of the program. Also you would not have an equal level of competence in thinking whether it should be changed. That in itself is a big thing.

People like Dr. Bradbury and his staff and his consultants think not only of how to do what the Government asks them to do, but they even think, "Is this what we should be doing?"

Mr. BALWAN. That would be true with the Lincoln project also.

Dr. HAYWOOD. Project Lincoln is an example. Yes, sir.

Mr. RIEHLMAN. Are there any other questions on that point?

Mr. BALWAN. I would like to get the doctor's expression on some of these hypotheses which we have about the research and development program. I do not think he answered those in his letter.

Mr. LANTAFF. I am wondering if in answer to these additional problems on certain hypotheses, whether or not the doctor might want to analyze those and think about them and submit his answers for the record.

Mr. BALWAN. I think they are short and we might be able to get hiw views better this way very informally.

Mr. RIEHLMAN. If he feels he would rather give it to us.

Dr. HAYWOOD. I would just as soon give them now if it is the same to you.

Mr. BALWAN. All right.

One, civilian scientists in military research and development centers are reported to be generally dissatisfied with military domination and administration.

Based upon your experience in research and development as a military officer, what would your observation be to this subcommittee?

Dr. HAYWOOD. I do not believe there is a general dissatisfaction.

Mr. BALWAN. Is there any kind of dissatisfaction?

Dr. HAYWOOD. There is dissatisfaction of some civilians; there is dissatisfaction of some military; and there is a very substantial turnover of scientists in industry. Scientists are fairly free-thinking people and they tend to move.

Mr. BALWAN. Is it a weakness that we should be concerned about? Do you think that to the extent this does exist, does it exist to that degree that we in Congress should be interested in this, or concerned?

Dr. HAYWOOD. I think it is unfortunate the way it has occurred in a few places. I do not think it is correct to take this as typical of all

research and development. I do not feel it is a question of primary consideration by the Congress. If something like this were occurring at the majority of the Air Force centers or Navy centers then it would be certainly a very serious problem.

Mr. BALWAN. You at Sylvania have hired several scientists who have left military centers, such as Cambridge and the Naval Research Center and some others; have you not?

Dr. HAYWOOD. Yes; we have.

Mr. BALWAN. Very many of them?

Dr. HAYWOOD. Quite a number, but they did not leave because we had a job for them. Of my 4 key people, 2 of them just came back from extended assignments overseas—tours of civilian duty overseas. But when a man comes back—1 of them had 5 years in London—he returns to a going organization. They have no position in the States of equal level. He goes into a less interesting job, or looks outside.

About half of ours are in that position. Dr. Schneider you know about. There is a similar man who left the Special Devices Center for personal reasons. We have not made—as far as I know, and certainly not to a high level person—we have not made an offer to a man who was satisfied in the Government employ and who we sought out and made an offer. But it is true we have gotten several good men from Government service who had independently decided on a change.

Mr. BALWAN. The next question is, civilian scientists are leaving military research and development centers. Can we assume that as a fact about the research and development program?

Dr. HAYWOOD. I do not know overall that there are more leaving than are joining. I know a number are leaving and there are some very good ones. One should really have statistics before he answers on one part of the problem. Who is replacing them? Are they equally good? And how does the whole picture look? I do not have that information.

Mr. BALWAN. Next. When a military organization is imposed on a research and development program there is a tendency for the military to expand its control over technical decisions and operations in the research laboratories.

Dr. HAYWOOD. My reaction to that is, good. That is a function of management—to control, and if it is a military organization the military should control the technical operations. I do not make a distinction in my mind as to whether that control is by a man in uniform or not. But the research and development organization in all of our services is part of the military structure. Even if it were all civilian I would say the same thing, that it is part of the Military Establishment. And there should be military management of it. Again I put the "military" in quotes, and mean management by persons, in uniform or not, who are responsible ultimately to the Secretary of Defense, and through him to the Congress.

Mr. BALWAN. And he might be a civilian?

Dr. HAYWOOD. He might be a civilian.

Mr. BALWAN. Employed by the military, and you would call him military?

Dr. HAYWOOD. I would call him military management if he is responsible to the Secretary of Defense and working in the Military Establishment.

On the other question, from my point of view it becomes academic if you say that the manager is a man selected for his qualification for the job, as to whether he is in uniform or not. Then it is his function to impose control; and he should. I do not think anybody in my office in Baltimore would say I did not control it; and I feel that was my job.

Mr. McCormack. You mean by that you assumed the responsibility of making decisions.

Dr. Haywood. That is right.

Mr. McCormack. And whatever the decisions were is what you mean by control.

Dr. Haywood. I mean approving the objectives of the organization as a whole and the objectives of the principal components; analyzing the resources for these objectives; defending the budgets for them and approving the budgets for them; and evaluating the accomplishments of these groups.

Mr. McCormack. But not imposing a military spirit or control?

Dr. Haywood. No. Not in the sense of punching a timeclock.

Mr. McCormack. You have had plenty of years of experience and know that the fellow in command does not have to make an overt act, but can develop a spirit which quickly affects everyone all along the line. The military spirit is the easiest thing in the world to instill in an organization—even a civilian organization. Without any overt act at all. You realize that, don't you? And it is no criticism of the military. But there are different types in every walk of life. You know that. Of course, if somebody underneath you issues an order to somebody below, even if you do not agree with the order, you probably in most cases would back him up or tell him in private conversation you did not agree with him, but do not do it again in the future.

In other words, you could not publicly humilitate that officer under you because his future usefulness would be seriously impaired.

Dr. Haywood. It is equally true of your civilians. You cannot do that to them either.

Mr. McCormack. It is more true strictly in the military than in the civilian, is it not?

Dr. Haywood. I would not say so. I feel it is true all the way through. You have to build up the authority and confidence of their people in your own subordinates. You have got to be sure your subordinates can handle their job whether they are military or civilian. But having made that basic decision, then you support them, and accept the responsibility for their mistakes.

Mr. McCormack. Fear is the easiest thing in the world to generate and spread. You recognize that?

Dr. Haywood. Yes, sir.

Mr. McCormack. It can be generated and spread without an overt act, but done by the key individual, whether military or civilian. You realize that, don't you?

Dr. Haywood. Yes.

Mr. McCormack. I would assume within the question you had in mind, Mr. Balwan, it was not a question of assuming responsibility in the position, but whether there was any military dominance which created in the minds of the scientists and the others employed in the place, the feeling that they were subject to military life rather than civilian life.

Mr. BALWAN. A military type of control with its regulations and all that goes with it, is what I meant. I think you answered that and Mr. Lantaff paraphrased it before.

Mr. MCCORMACK. You can tell us about whether you have observed it as a result of your experiences.

Dr. HAYWOOD. There is no question that if you come in and try to run a research laboratory like a troop unit in the field it is going to fail. But my point was, this is not because it is military domination, but because it is run poorly.

Mr. MCCORMACK. Because of what?

Dr. HAYWOOD. It is run poorly. The management is not compatible with the nature of the work and the objectives of the organization.

I would like to correct one thing too. You talked about us getting a number of people recently from Government. We have had some very fine recruiting very recently from a large industrial concern in our area. They decided to move their laboratory rather arbitrarily and have put in timeclocks.

There is no military involved there. They looked at the situation and said, "All the girls punch timeclocks and all the janitors punch timeclocks, and the watchmen punch timeclocks, so we will have our scientists do it." Well, they leave.

This is just a question of management not fitting the organization. Civilians make mistakes too. There may be more of a tendency if a man has a background of having done nothing in his life except run military organizations, that he would try to bring in a management not responsive to the situation; but not because he is military, but because the individual does not have the background for the job.

Mr. MCCORMACK. Having in mind research and development, he might have a background for some other job in military life.

Dr. HAYWOOD. That is right. Oh, yes.

Mr. MCCORMACK. And be a fine man.

Dr. HAYWOOD. Certainly.

Mr. MCCORMACK. But this is a peculiarly sensitive field that has got to be appreciated and understood by those in the military as well as in all of our armed branches. The scientist on the other hand has to have an appreciation of his responsibility.

Dr. HAYWOOD. That is true.

Mr. MCCORMACK. In order to develop the teamwork.

Dr. HAYWOOD. I think under the existing situation—I realize that if we changed the philosophy, 10 years from now it might be different—I think most civilian scientists in the Government service like to have a qualified military man at the head of the organization. I believe the reason is that the military man can normally get better support for the organization from his superiors. A better working condition may exist for the civilians if they have a good military leader who can really sell the organization to the part of the Military Establishment that does not understand technical work.

Mr. MCCORMACK. I think the testimony has been universally that, and there has been no one taking a position contrary to that, as I can remember, except that there were some who said that in the setup of the organization there should be a civilian in a high level of command. Do you agree with that?

Dr. HAYWOOD. I agree with that.

Mr. McCormack. That leads me to this: What is your opinion as to an Assistant Secretary of the Army, Navy, and Air Force, for Research and Development?

Dr. Haywood. An Under Secretary instead of an Assistant?

Mr. McCormack. No.

Mr. Balwan. In the service department. We have one at the OSD level.

Dr. Haywood. We have one in the Air Force.

Mr. Balwan. No. He is special assistant to the Secretary with rank of Secretary.

Mr. McCormack. You have Assistant Secretary of Defense for Research and Development, but not for the three component services of the Defense Department.

Dr. Haywood. If it enhances his prestige and authority I would say it is a good thing. I think research and development is one of the most important parts of the military work, and that if this is going to give greater recognition, I would say decidedly it is a good thing. I believe myself that Mr. Trevor Gardner in the informal working of the Air Force has as much authority as he would have as an Assistant Secretary. Now maybe outside the Air Force to other people he would have more prestige with a different title. But it is sort of what I said before. It is the people who count. If you made him the third assistant to the Secretary the people he worked with would soon recognize his ability and the fact that the Secretary supported him, and that is all he needs.

Mr. McCormack. Yes, but an organization cannot produce perfection, but an organization can produce in net results with the highest type of man humanly possible under the circumstances for an assignment of this kind in the military. Is that right? So that your organization brings in the younger officers, instilling them and getting them into the laboratories, and giving them assignments, and broadening them out, and not putting the officer in the field for 2 or 3 years and then out in the command of troops, but keeping him in related activities and having in mind an objective so that as they go along they are making more and more of a contribution and in time will take command positions. Is that in a broad way what you have in mind?

Dr. Haywood. Fine. Yes, sir.

Mr. Balwan. I am a little embarrassed to read the next. It says, with a few notable exceptions, military research and development officers are not scientists who command the respect of the civilian scientists. Because the gentleman we have as a witness here was a military officer, but it might be good if you just comment on what you know about the technical competence, or now many officers we have. Are we short of them?

Dr. Haywood. We certainly are short of them and you need make no exception. I do not pretend to be a scientist. I have said often that in a group of officers I may be a scientist, but in a group of scientists I am strictly a military man. I have done enough scientific work so that I believe I have some understanding of it and what it may take to do good work. But I have never published a truly scientific paper. I have done some scientific work at Los Alamos but it was classified.

There is no question but that the services in general and the Air Force in particular do not have as many technical officers as they could use, if they could attract them into the service. At one time, and it

may be true now, I think there was something like one-third of the Air Force officers who were college graduates. It is very difficult to manage any type of technical program when the man is not even a college graduate. You deal with people like Schneider who had 5 years of graduate work. You certainly have to have an elementary understanding of what the field is like if you are going to be in it.

It is a very serious problem because the simple solution would be to say, let's take all the technical officers we have and put them into the research and development program. That would be a mistake also. You need technical people in other parts of the Air Force and there are not enough to go around.

Mr. RIEHLMAN. What can we do to correct that situation and get more in the service?

Dr. HAYWOOD. One thing is to make the service more attractive overall. Make it attractive as a career—sort of along the line of my letter of resignation. I think that is the basic one and the most fruitful approach.

One does not plan to get rich in the service, but it is a nice group to be with. They are people you generally like to associate with. So if it is reasonably attractive as a career for the family—and I think the pay means more to the family and to the officer because of his family than it does to the officer himself—qualified people will stay in the service.

Another thing is that the services—and this I do not think Congress can do and I do not think they should do—the services themselves can make technical careers more attractive. Perhaps the assistant secretary status would enhance the prestige of the civilian handling research. That is the type of thing necessary; to make it clear from the very top that we really recognize technical work is important.

Mr. BALWAN. Mr. Chairman, I would recommend that we dispense with the reading of the others because we have discussed a lot of them. However, I do think if we could ask Dr. Haywood to send us a statement on them it would help our record.

Mr. RIEHLMAN. Would you do that?

Dr. HAYWOOD. A statement on the other six?

Mr. RIEHLMAN. Yes.

(The requested material is as follows:)

V. The policy of rotating assignments for military officers militates against the retention of officers who in some cases have the training, talents, and disposition to guide scientific research centers.

Answer. I have already indicated my feeling that the primary problem is not the rotation itself but the lack of sufficient qualified officers to manage all of the technical operations. The rotation thus causes a marked change in the competence of management and a resultant dissatisfaction among personnel and loss of efficiency in operation. I consider that rotation of qualified managers with reasonable tours of duty of the order of 4 years for each assignment can be a source of strength rather than of weakness for the organization as a whole.

VI. Research centers often are organized and administered as military organizations with the attendant restrictive forms, procedures, regulations, and military discipline which do not provide the optimum climate for research work by civilian scientists.

Answer. This tends to be most serious when the commander of the operation as a whole is not qualified to manage research operations. It is certainly true that some military research operations are severely handicapped when the military commander is charged with duties such as the operation of bases, supply depots and other strictly military activities in addition to his technical responsibilities.

Frequently the commander is selected for the larger, dollarwise, part of his total operation and is not qualified to handle the more technical aspects. Research centers should be organized as such and not burdened with unnecessary support of other military organizations which happen to be in the area.

VII. The lack of either a definite or consistent policy for organizing and administering research and development centers leaves each center at the mercy of each change in commanding officer and executive. This creates an instability with no assurance that even the well run research and development center will not become, with a change of officers, an unbearable situation.

Answer. I believe strongly in decentralization. A definite or constant policy for administration of all research and development centers which severely restricts decentralized judgments and actions would not increase the effectiveness of the program. The real problem is to assign managers who are qualified to maintain effective technical operations. This can only be accomplished if persons qualified to select such managers for the field operations are available and assigned to the higher headquarters.

VIII. Several outstanding civilian scientists who have been associated with military research and development programs are reported to be in favor of changes in the governmental organization and administration of these programs.

Answer. I have heard of many recommendations for complete reorganization of the military research and development organizations. It is my opinion that no reorganization alone will have a marked effect on the efficiency of the military programs. In 1949 the Ridenour committee recommended certain measures for the Air Force to implement in order to increase the effectiveness of its research and development program. The basic recommendation was the establishment of the Research and Development Command. It is my opinion that the most fruitful action for the immediate future insofar as the Air Force is concerned, would be to implement those portions of the Ridenour committee report which have not yet been implemented.

IX. The funding of research and development is confused when handled with military budgets. Direct research and development costs are justified to and appropriated by the Congress as such. However, this does not give a true picture of the actual total cost of military research and development programs inasmuch as there are substantial indirect costs arising from military support functions in the form of pay for uniformed officers, provision of capital facilities, and certain maintenance and operation expenditures.

In this connection, it is reported that it is often felt necessary to build up a research and development center with such support functions in order to make it "respectable" in terms of size and complexity as a command for a colonel or general. This, in turn, sets off a vicious cycle in that the existence of military support elements becomes a further excuse for military domination, more officers, regulations, etc.

Answer. It is a question of competent management. If the efficiency of a commander is judged on how large he can make his organization, there will be a tendency toward unnecessary expansion whether it is a military, university, or industrial operation. If superiors cannot judge the resources required for the responsibilities they delegate, it indicates a deficiency in these superiors. The vicious cycle to which the question refers does not arise when managers at all levels up to the top are qualified for their positions. The basic fault is not in the field commanders who expand their activities needlessly but in their superiors who do not properly inspect and assess the responsibilities, resources, and accomplishments of their subordinates.

Mr. BALWAN. I wonder if in the closing question—and maybe the other members and you, Mr. Riehlman, would like to ask it—would you have any recommendations or any observations to make about our total research and development effort and its weaknesses, or do you think you have discussed them? Are there any things we ought to be concerned about either from an organizational point of view, or philosophy? Mr. Lantaff asked a question similar to that of some other person. I have forgotten who it was.

Dr. HAYWOOD. There are so many aspects that come into it. Like I sort of rejected bodily the idea that it will be all fixed by an organization or reorganization. Mr. McCormack's suggestion, which is really a reorganization in a sense, or a change in the designation of the top-

man, is one of the steps toward prestige and attractiveness. Many of these put together will correct it.

The other is, the big difference in attractiveness, particularly to the young man, when they are making their decision of, "Do we go into a service career or not." It is quite a hard choice for him if he is really anxious to take a service career, as he is giving up a great deal.

Mr. BALWAN. I mean substantively in the program, are we making the program we should be making? Were you as an officer, when you were in the ARDC, concerned that we were falling behind or barely keeping up, or did you have a problem of that nature?

Dr. HAYWOOD. Well, in many fields we are certainly not keeping up to the Russians, which is a very alarming situtation. Whether it is because of the type of people we have in the program, or the approach, or the amount of money we are spending on it—whether the fault is within the Government or on the contractor's side is a very complex problem. There is no one factor which you can say this is the reason. One factor goes way beyond what the military can do anything about. Russia is turning out 2 to 2½ times as many scientists and engineers from their universities each year as the United States. We cannot think of Russia as being an uneducated possible enemy. It will not be many years until they have a greater pool of technical people than we have. They are turning out more now. We had more to start with, but they are closing the gap. That is an alarming situation.

I do not know of any clear corrective action. The National Science Foundation was a step in the right direction. It is going to help the situation for a few people. Of course, even there I am not convinced that the objective of turning out more graduate students in science is best accomplished by giving money to individuals. The universities subsidize education to about the same amount as the student's tuition, and to some extent I am convinced that the National Science Foundation simply funded different people to go to school, but did not increase the number; because the university by itself just could not afford to increase the number of students it could accept, because they could not subsidize more. That is one part of the situation which is long-range, but it is certainly necessary. You cannot produce good weapons without good people.

On obtaining better direction of the program, I have indicated several times that, regardless of what other steps are taken, the most fruitful ones of all will be steps which encourage better people to get into and stay in the program. Either contractor people, or the Government people in the laboratories, or the military people, or the civilian top personnel directing the program. Whatever can be done to make it more attractive to keep qualified people will be a step in the right direction.

A final consideration is that there is a tendency to overcontrol. Every time someone stumbles on a project or duplicates some existing project, someone imposes another control or establishes another level of review. Someone called the Research and Development Board the Retardation and Delay Board. It is very true. You just cannot wait to have all of these levels of review, regardless of how good the people are. If we can just do a better job of attracting competent people and give them authority to go ahead with large

parts of the program, we would save money for the taxpayer and be further along in the program.

It is one of the great advantages, I believe, of democracy over dictatorship, that it permits a decentralized authority which tends to correct mistakes. I believe we are hurting this great advantage if we just take an attitude that the primary consideration is to avoid all mistakes. It is better to get a project started, and cut it off quickly when we find out it is a mistake than it is to subject everything to such a long review that we are bound to be late in accomplishing everything.

Mr. RIEHLMAN. Maybe tomorrow when you read the transcript, you may want to elaborate on some of these points. If you feel you can we will certainly appreciate it—particularly in these last remarks you have made.

Does anyone have any other questions of the doctor?

Mr. LIPSCOMB. Yes. I would like to ask about the budget at Baltimore. Did you prepare a budget for the Department of Defense on the Baltimore work that you did on research?

Dr. HAYWOOD. Not I alone. Maybe I misunderstood the question. I supervised preparation of the one for my office. I participated in review of the research program for the command as a whole.

Mr. LIPSCOMB. What was the last budget you were associated with? What year?

Dr. HAYWOOD. I tendered my resignation a year ago April. I was associated with the budget that was voted on in the summer of 1953. That would be the fiscal 1954 budget. I was in on the early preparation of the 1955 budget.

Mr. LIPSCOMB. You indicate that there was $5 million, was it?

Dr. HAYWOOD. I believe that is in the 1955 budget that the basic research was taken out.

Mr. LIPSCOMB. But you indicate you have knowledge that has been deleted.

Dr. HAYWOOD. Yes.

Mr. LIPSCOMB. When you left Baltimore it was in the budget?

Dr. HAYWOOD. Yes.

Mr. LIPSCOMB. At what point was that deleted?

Dr. HAYWOOD. It was deleted after I had left. I don't know exactly when. There was pressure from someone. I think the Bureau of the Budget, because of duplication with the National Science Foundation. The Navy and the Army fought it. The Air Force said, "It is easier just to eliminate basic research."

I point out it is not seriously affecting the program, but it is the type of thing that really makes civilian scientists leave. They say, "Well, how can we go out to other scientists and say, 'Come on into our program, but just don't call it basic research because we cannot do that.'" The Air Force is almost forced to do the same type of work, but just to call it something different hurts. It hurts the reputation of the people in it and it hurts the publicity which the program needs to get good sources for future work. You have to get ideas from outside as to what may be good in science.

Mr. LIPSCOMB. Do you feel the research and development program is seriously lacking in sufficient funds?

Dr. HAYWOOD. No; I do not. I did not feel that when I was in it. In fact, I strongly believe it would be better to have a smaller program

which is stable year after year than to have even the existing level and have it, say, every third year, get a 50 percent increase or decrease.

The other thing is, as you well know, Government budgets are quite different from costs. I am referring to what is called research and development in the budget. Pay of the Army is a separate item so military people are not charged against research and development. Pay of civilian employees is in research and development, but a different line from the scientific fields—I think 690—and it gets complicated. I think the level of effort of the services is quite reasonable. If the Nation could afford a higher level I believe it could be spent profitably, but I also believe that there is some optimum—you take a risk. You know the Russians are ahead in some field. At this level they will stay ahead in this field; but you cannot afford to put more into it.

There is also a point of diminishing returns.

Sylvania, for example, feels that there are certain general limits to the amount of defense business a given company should have. I mean a company which is in both the civilian and military goods business and is not inherently, by the nature of its products, wholly civilian or military.

In the case of Sylvania, our defense business has been running at about 20 to 25 percent of total sales, which seems to be a proper proportion. To go beyond that would tend to cause our business to be too heavily weighted in one direction, and diversity is extremely important in achieving business success.

This situation is certainly not common to Sylvania alone. Whereas any industry recognizes that defense business is an obligation and a responsibility any company must enthusiastically and wholeheartedly accept as a corporate citizen, it also recognizes that it has a concurrent obligation to assure that its overall operations are sound and balanced.

There is a further consideration. Aside from simply the magnitude of its defense business, a company engaged in technical work is further faced by the implications of assigning its large technical staff to research and development projects for the Government. These people must be of extremely high caliber, and assigning them to Government projects means that they are diverted from civilian projects which are vital to the company's long-term progress. Even though all of the expenses entailed in the assignment of technical people to Government projects are, of course, part of the Government contract, the company is nevertheless deprived of the fruits of their research and engineering in its civilian lines—that is, the development of new products having extremely important future implications.

Looking at the problem from the standpoint of those who plan military spending, there are a number of larger considerations. One, of course, is the consideration of the country's ability to sustain a certain level of defense spending, without disrupting its civilian economy. Certainly no enlightened individual will disagree that high levels of defense spending will be with us for many years to come, and that defense spending has long ceased to be in the category of something which occurs every now and then. However, there would appear to be a point of diminishing return which would be reached when defense spending reaches a level which is out of all proportion

to civilian production. Granted that defense spending cannot help but enormously outpace civilian spending in times of war or periods close to actual war, in less critical periods there is a point at which defense spending can actually be excessive, in the sense that the level of such spending is more than the economy can efficiently absorb.

Mr. LIPSCOMB. Did you indicate that you felt there should be very little in-service research?

Dr. HAYWOOD. I hasten to add I was almost alone within the service in my point of view. I fought against in-service research for 2 years in the service and we did none in my office. Let me add that I wrote a paper on the theory of games but it was more or less an avocation, more to keep my hand in. I made it clear to all my people, civilian scientists as well as the military, that they were being judged on how well they selected outside sources for contract research projects, and how well they followed the contract work. If in doing their job, they had time for some research themselves, that was all right, but that was not what they were paid for.

I would rather have a man come in and administer contracts and aid in monitoring a $5 million program and not worry about a $5,000 project of his own; and then give him a year off to do his own $5,000 work—if that is the way to keep him content and effective.

I am sort of a fanatic on the subject. I think you have to make up your mind, are you doing research yourself, or managing the research of others. I do not believe you should mix them.

There are very few in the service who are as extreme in this matter as I am. I particularly believe that it is not justified to have a laboratory within the Government for the training of people—scientists—to do research; to support a Government laboratory other than for research accomplishments. My basic premise for this conclusion is that the only way you can keep your hand in is to do good work, and if the work is not good enough to be supported on the basis of actual accomplishments, then it is not good enough to be used for training.

There is another side to it which people will argue. Many say you need the in-house laboratories in order to be competent to judge the outside work. That is where I disagree. I say the only purpose of an in-house laboratory is to accomplish research; and if it does not do that, to support it solely for the maintenance of individual proficiency is less effective than if you let those people get sabbaticals back to industry and university research, just as universities give sabbaticals to keep professors in touch with the nonacademic life.

There is a very severe problem that will certainly arise if the Government were really to go all out for what I have advocated in the way of large-scale contract operations. That is in the field of proprietary information. If you invent anything with respect to the atom the patent belongs to the Government and the Atomic Energy Commission pays you for it, whether you are in the program or not. The Government has the right by statute to the patents. That is not true in the fields that support the Air Force. It means that if you give a job to one industrial concern to establish an Air Force "Los Alamos" to make aircraft, the other industrial concerns may not give this contractor their know-how. This is a real serious problem.

Mr. BALWAN. That came up in Mr. Gardner's testimony.

Dr. HAYWOOD. It is a management policy that in the atomic-energy situation works out nicely, but it may be a little too unique to implement on a wide scale.

Mr. LIPSCOMB. You indicated Russia is turning out approximately 2½ times more scientists than we are at the present time.

Dr. HAYWOOD. Scientists and engineers.

Mr. LIPSCOMB. Do you have any information as to the quality that they are turning out?

Dr. HAYWOOD. Russia always has had good scientists. They have tended to be—I studied at college a book on the theory of elasticity by a Russian and it was one of the most advanced in the field—Timoshenko. The recent development is they are turning out large numbers. In the past we have tended to think of Russia of having good scientists but being weak in numbers and in technology. Now the mere fact that they are turning out these great numbers—and we know they can produce good ones—is alarming.

The other thing is they have some nice accomplishments. We can see them flying and we can pick them up in other ways in their atomic work. I am not the authority to testify on it, but if you want to go into whether they have accomplished anything in their atomic research I think you would find out they have accomplished a great deal. They are certainly not taking high-school graduates and giving them a Ph. D. so as to simply increase the number of Ph. D.'s.

Mr. MCCORMACK. Certainly they accomplished something in the hydrogen field and atomic field 3 years before our Intelligence thought they would.

Dr. HAYWOOD. Yes.

Mr. MCCORMACK. And they had this jet plane, which is certainly something. They have increased their power tremendously since 1951. They may have the same number of land divisions—about 175, as I understand it, but their power has increased tremendously. They are supposed to have 20,000 combat planes which are practically all jet now. Only a matter of 3 or 4 years ago they were not. They have revolutionized their military power, as I understand it.

Mr. LIPSCOMB. Aren't they accomplishing that rapidly because they have been able to copy a great deal and then to enlarge upon that?

Dr. HAYWOOD. Yes and no. I do not think there is any question but that in a number of fields they are ahead.

Mr. LIPSCOMB. But we did a lot of the basic work on the atom.

Mr. RIEHLMAN. Can you elaborate on what fields they are ahead of us in?

Dr. HAYWOOD. I think it should be off the record.

(Discussion off the record.)

Dr. HAYWOOD. Everyone does that. We started in on our rocket work with German scientists to a very large extent, and we are still using them. The Russians got German scientists too. Both nations have used the knowledge of the people that became available. It is just the sensible approach to look at where the state-of-the-art stands and see what we can do with it. My point is they have not simply copied. They have gone beyond what they got. They have done good, original work.

Mr. RIEHLMAN. Are there any other questions? Mr. McCormack? Mr. Lantaff?

Mr. LANTAFF. I have a couple of questions which because of time the colonel can answer and send back to us, if he wants to. But I would like to ask them because it has come up in connection with other things.

The problem of maintaining maximum security without impeding scientific progress is, of course, one that is complex and difficult. Do you think that the present loyalty program is predicated upon the Executive order, or its application or interpretation, is serving the best interests of the United States insofar as it affects the research and development program?

The second question: Do you know whether or not any scientists have left or are contemplating leaving Federal service because of the loyalty program, or its application and interpretation?

Third, do you know of any scientists who have refused to work for the Government or on Government contracts, for fear of being classified as a security risk?

(The responses to the above three questions are as follows:)

ANSWERS

1. I know of no specific incident where the present loyalty program adversely affected military research and development and have no personal knowledge of any scientist who has left or contemplates leaving or refused to enter Federal service because of the loyalty program.

2. In a broader sense we should keep in mind at all times that the Nation pays a severe price for its security program. It is paying for a short-term advantage, vis-a-vis potential enemies, by accepting a long-term loss. If we could be sure that we would face no major war in the next decade, I am convinced that we would be better prepared for war thereafter if we had no security restrictions today on our current work. The difficulty is that no one can look with such certainty into the future.

3. A security program is expensive—in money to administer it, in ineffective use of rare talents through unintentional duplication of scientific and engineering projects, and through slower technological progress through denying industry the use of classified military research results for their commercial products. To cite an example, I was in the atomic program at Los Alamos just before joining the Air Research and Development Command in Baltimore. We received proposals in Baltimore from outstanding scientists to do work which I know had already been done at Los Alamos but never made public. Metallurgical research essential to atomic weapon development might be equally essential to aircraft development. If the Atomic Energy Commission, for reasons of security, cannot release their research data, the aircraft industry may have to do the same research for their military program. This is more costly in the loss of skills of highly competent scientists who otherwise could be doing other needed research, than it is in dollars.

One administrative procedure of the loyalty program which is needlessly wasting time, money, and talent is the refusal of the military services to initiate security clearances prior to the actual date of employment of an individual for a classified project. There appears no reason why such clearances cannot be initiated when the prospective employee accepts a firm offer of employment. Frequently this is 2 months or so before he actually joins the organization. A simple procedural change which permitted initiation of the security investigation upon acceptance of a firm offer of employment might cost a few thousand dollars for the investigative agencies but would save millions for the taxpayer in the way of more productive contractor work. Incidentally, the Atomic Energy Commission follows exactly the procedure I am here recommending, i. e., it is willing to investigate a prospective employee before he actually joins the contractor's organization.

Mr. BALWAN. We will send you the transcript.

Mr. LANTAFF. Yes.

Mr. RIEHLMAN. Are there any other questions by the committee?

Mr. BALWAN. Have we acted on the insertion of the letters into the record?

Mr. RIEHLMAN. We have a number of letters from outstanding scientists and people throughout the Nation. We have written to some of them and we have sent them a list of the same types of questions we have sent to the doctor here and other scientists throughout the Nation. There are certain portions of those letters that are of an important nature and have a substantial bearing upon our investigation, that I think we would like to read into the record. I do not think it is necessary to read all of the letters. They are too voluminous, and so forth; but those that we have a particular interest in.

I have asked two of the staff members, Mr. Balwan, the director, and Mr. Brewer, to go over them carefully and take out those certain portions and read them into the record. If it is permissible I will either do it while the members are present, if you would like to hear it or I will ask that that be done by Mr. Balwan and Mr. Brewer and we will be furnished a copy so that we will have a chance to read them over.

Mr. MCCORMACK. I think the latter.

Mr. BALWAN. They are extremely interesting, though.

Mr. RIEHLMAN. As Mike said, they are extremely interesting and I hope each member will get a chance to read all those sections.

Mr. LANTAFF. I think that spadework will be of benefit to us in the preparation of our report.

Mr. BALWAN. Mr. Brewer, will you proceed with the letters which we have from these scientists?

Mr. BREWER. Mr. Chairman, the pertinent parts we are reading are taken from the full letters which will be presented in their entirety later in the record. The first letter is from Prof. Robert B. Brode, professor of physics at the University of California. It reads:

I am well aware of the difficulties that the Defense Department has in operating research and development stations within the military structure, and I believe that it is important that something be done to alter some of the existing conditions. Many of these problems are created in some measure by the unnecessary application of procedures and rules that have been found useful or traditional in regard to ships and yards, but which are inappropriate to scientific laboratories. The frequent rotation of personnel in important and policymaking positions places a considerable burden on the scientific personnel for the indoctrination and education of superior officers by subordinate scientists. The past experience of many of these officers has not been of the type that would prepare them to work with or deal with the problems of a scientific laboratory.

The continued control of details of many of the developments from desks in Washington leads to difficulties in the development program. The long-range planning of research and development programs cannot be detailed in the same way that estimates can be made 2 years in advance of the supplies required for a ship or yard. With new discoveries and changing needs, the program 2 years from now may be in many phases unexpectedly changed. The economy measures which are appropriate for a business establishment may operate quite differently in a research and development laboratory. Restrictions on travel, telephones, automobiles, etc., may show decreased expenditures without decreased output in some business enterprises; but a research and development laboratory, where the output is not readily measured in dollars or units, may perform much less efficiently as the result of restrictions which were intended to improve the efficiency. Since so many of the difficulties encountered in operation of these laboratories arise from application of regulations that are made for quite a different type of establishment, that is, the armed service itself, it seems probable that an improved operation could be achieved if much of the laboratory work were in a somewhat independent branch of the armed services. One could propose the creation of a Secretary for Research and Development who would have operating units in his

jurisdiction. For the purposes of liaison, military officers would be assigned to these laboratories but not normally in positions of administrative responsibility.

The next letter is from Mr. Ralph Connor, director of the research laboratories, Rohm & Haas Co., Philadelphia, Pa. This letter should be of particular interest because it involves the viewpoint of a manager of a large industrial research laboratory. This begins:

From the questions you have asked, it is obvious that you have a major concern as to whether there is anything fundamentally wrong about military control over research. I think there are probably some prejudices on this point, but as I have indicated, I see no difficulties with them so long as the proper relationships are maintained. So long as good scientists work on a good program under conditions conducive to good scientific work, it makes little difference what the organization is, and the proper head, whether civilian or military, will make this work effective if he has the right support. I believe that most scientists who are worried about military control are comparing military establishments with the best civilian laboratories. Actually, this is not the comparison which must be made; the comparison should be between Government laboratories operated by civilians and Government laboratories under military control. It is my impression that the main deterrent in hiring men for Government work does not have a relationship to whether the control is military or civilian; I think the main obstacle is in hiring people for Government work. Events of the past few years have not tended to make people feel that in working for the Government they can necessarily be proud of the fact, because there seems to be a good bit of sentiment that many Government employees are not necessary or are not giving faithful performance.

In addition, scientists who have read of the incidents concerning Condon, Astin, and Oppenheimer—even if they may not have an opinion about these specific men—are not confident that they can receive gratitude and just treatment as a reward for devoted work. For this reason, it may be desirable to increase the amount of work which is done under contract. Aside from this, the most important contribution to obtaining competent scientific personnel will not depend upon whether administration is by civilian or military but will depend upon making prospective employees feel that they will enter into work which is important and respectable and which will be appreciated if done well.

The next letter, Mr. Chairman, is from Dr. S. D. Cornell of the National Academy of Sciences, Washington, D. C. In a rather lengthy letter Mr. Cornell goes into the general problems affecting the program, particularly pointing out the limitations of the command structure in the military organization and the problem of military turnover involved in the rotation program.

The points we are taking from the letter deal with questions 2 and 3. Question 2 reads:

Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical, personnel?

On that point Dr. Cornell answers:

The answer to the second question cannot, in my mind, be given categorically. Poor organization of research and development in the military services can certainly create adverse conditions for effective work and for effective recruiting of scientists. But this is true of other environments as well and I do not believe that military establishments must inevitably organize research and development poorly. Properly organized, a military research and development program probably does not face any greater problem of effectiveness or of recruiting than would the same program under other Government auspices with similar pay scales, living conditions, and so forth.

Under question 3, which reads:

Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?

Part of Dr. Cornell's answer is as follows:

I am inclined to feel that one of the major defects of the present system lies in the necessary preoccupation of the military services with short-term problems—the requirement of day-to-day readiness of the fighting forces. This inescapable responsibility focuses military thinking on the improvement of present weapons, either through quick-fix remedies for defects as they are uncovered or through a more or less steady evolution of improved designs without basic change in weapons concepts. The military services themselves have recognized this difficulty and have taken steps to counteract it through the establishment of groups, from time to time, that are specifically charged with forward-looking thought and planning with regard to weapons.

But it seems to me that there is still room to consider whether a civilian-led research and development organization on a small scale, charged with research on fundamentally new weapons, responsible for bringing free and imaginative thought to military problems, and equipped to explore the resources of science for new approaches to such problems, might be profitably added to the research and development activities of the Department of Defense as they are carried out today.

The next letter is from Mr. James B. Fisk of the Bell Telephone Laboratories, Murray Hill, N. J. In addition to Mr. Fisk's experience with the Bell Telephone Laboratories, he has also had experience in the Federal Government's program of research and development. The letter reads in part:

* * * there is a broader question not raised explicitly in your letter which may deserve mention here. This has to do with the technical mission or charter which is given to a laboratory. I am persuaded that the primary and necessary condition for the success of a laboratory of the sort we are here discussing is a comprehensible and important task. This, together with leadership in the laboratory and in the management above the laboratory, is a condition which must be fulfilled before many of the subsidiary questions have significance. For example, there are many Government-supported laboratories well equipped, with able-enough people, but whose charter or mission is ill defined or lacks focus, or whose direction comes from some remote agency whose understanding of a military requirement may not be matched with equal comprehension of the technical possibilities for meeting the requirement.

The next letter is from Dr. George R. Harrison, dean of the School of Science at the Massachusetts Institute of Technology. Dr. Harrison served as Chief of the Optics Division of the National Defense Research Committee from 1940 to 1946, and as Assistant Chief of the Office of Field Service of the Office of Scientific Research and Development in 1944, during which time he served for a period at General MacArthur's headquarters setting up a Research Division for the Southwest Pacific area.

With regard to the first question you mentioned in your opening statement, Mr. Chairman, Dr. Harrison writes:

I believe there are characteristics inherent in military organizations which are incompatible with the administration of a long-term effective program of scientific research and development. Military organizations have shown themselves very effective in continuing long-term programs of development which have resulted from a strong civilian impetus, but in general there is likely to be a decline in imaginative resourcefulness once the military organization takes over.

With regard to the third question you outlined, Dr. Harrison writes:

I do not believe that it would be desirable to establish a civilian organization to administer military research and development programs except in an advisory capacity, and also except in time of emergency. During World War II there was very close cooperation between civilian and military agencies as a result of the fact that each was made more or less independent of the other. If the military had been in control of all research establishments at the beginning of World War II, a large proportion of the new weapons developed would not have been introduced. In my opinion, the Office of Scientific Research and Development

was outstandingly successful in breaking down the military barriers to the development of new weapons. Military minds are influenced by the military organization in the direction of being conservative in scientific matters. This works very well in the development of a new weapon after it has been invented and produced, but must be supplemented by the type of imagination which is usually found most among scientists, especially those who are nonconformists.

A part of Dr. Harrison's answer to the fifth question which is particularly pertinent to our inquiry reads as follows:

I believe that a certain amount of research should go on in all scientific laboratories of defense organizations, because only by this means can they keep their personnel up to date and attract a live corps of imaginative scientific personnel. I believe that the system we are now developing is a very good one, namely, the one in which a certain amount of weapons developments is going on in military establishments, a certain amount is being carried out in industry and in public and private educational institutions, and a fairly large amount of fundamental research is being supported through Government contracts. Much more needs to be done in the attracting of able young men, particularly those of imagination who tend to make the greatest inventive and scientific contributions.

The next statements, Mr. Chairman, are taken from a letter received from Dr. W. V. Houston, president of the Rice Institute, Houston, Tex.

With respect to the first question which we asked him in our letter he states:

I believe there are characteristics inherent in military organizations which are somewhat incompatible with the administration of an effective program of scientific research and development. Among these may be mentioned:

(*a*) The necessarily authoritarian organization of a military establishment.

He goes on to elaborate that point, Mr. Chairman:

(*b*) A military organization requires a certain interchangeability of personnel.

This also is explained more fully in his complete statement.

With respect to the second question which we asked of Dr. Houston he states:

I believe it is true that the military organization of a research and development program does tend to create conditions which retard the work of scientists and make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel. Part of this is associated with the necessary secrecy surrounding such work. Secrecy and scientific progress are almost contradictory terms.

Another part is due to the situation mentioned above under 1. The organization of some Government laboratories, in which there is a civilian director and also a military director, is a good step forward in meeting this problem. It is especially effective when both directors have a broad enough understanding of the situation to see the limits of their respective spheres of activity. It is still inadequate, however, if the military director feels himself responsible for the scientific output of the laboratory, or for maintaining a military atmosphere.

The next statements, Mr. Chairman, are taken from a letter received from Mr. W. E. Kuhn, manager of the technical and research division of the Texas Co. of New York. Mr. Kuhn states:

Certain research activities can be properly sponsored by Government participation. Basically, it is my opinion that Government participation in research should be kept at a minimum. In the field of modern weapon developments which are required to maintain the defense of our country and our world position at the proper level, it is necessary that the Government support most of the projects. Further, since this type of development requires field testing, it is apparent that participation by the armed service group is necessary to properly field test the device.

On the other hand, for the manufacture of materials or for methods of manufacture which are logically in the fields of industrial organization, even sponsorship by the Government agency is undesirable. In a few cases, developments

may be needed and if they are not forthcoming through normal competitive pressures a Government subsidy may be required. Industry has a responsibility along these lines and should avoid subsidization as much as possible. If industry is properly organized, there should be very little work in this category.

Dealing specifically with this question in our letter, Mr. Kuhn states in part:

In respect to Government participation in research, I would say that it is preferable in most instances that the work be done by an industrial or academic laboratory.

The next statement is from Mr. James L. Lawson, who is manager of the electron physics research, General Electric Co., Schenectady N. Y.

Dealing with the first question, Mr. Lawson states:

(*a*) The objectives of a research and development program controlled by a military organization are more likely to lean toward development and away from research. Military people seem more likely to back development than research, because it is easier to to visualize the end product and also its impact on military effectiveness. The freedom of inquiry which is so necessary to an effective research program is, therefore, likely to be suppressed. In other words, a program designed by military people is likely to be short range is nature, and too prescribed in scope.

(*b*) Military control in the past has tended to stifle research and development by not permitting adequate publication of results and interchange of technical information between groups engaged in work in the same general technical field.

(*c*) The traditional selection, training, and promotion of military men has not until very recently recognized the role of technology and research.

(*d*) The various accounting procedures now required in military organizations tend to discourage scientific advance. Budgets spent for research tend to be handled by people who like to know in advance what results will be obtained.

Under the second question in our letter to Mr. Lawson he makes five points:

Effective work from scientists requires the establishment of a particular "climate." Factors in this climate which, in my opinion, have been better handled by civilian controlled research groups are—

(*a*) Freedom of inquiry.

(*b*) Stimulation from other scientists.

(*c*) Ability to achieve recognition from at least the top scientists in his field.

(*d*) Continuity of policy and program.

(*e*) Management which is sympathetic to the scientists and which recognizes the importance of scientific long-range research.

All of these factors are very important in obtaining an effective long-range research program.

With regard to the fifth question in your letter, Mr. Lawson states,

A very serious problem raised by this question is the proper monitoring of research. You imply that "in-house" research is required for the purpose of exercising qualitative control over outside research. In my opinion, this idea is valid only if the quality of in-house research people who are judging the outside work is high. It does not depend on the quantity of in-house activity. I have had many experiences with military "scientists" who have a small "in-house" program of research going, and who are simply incapable of judging that field of work. Research monitoring should be done by people who understand the nature of research, and who have some experience with judging the possible and probable results.

The next letter, Mr. Chairman, is from W. Albert Noyes, Jr. This is a very detailed letter, Mr. Chairman, and I think particular attention should be given to this letter in its entirety. However, we are taking out two parts of it for inclusion at this time.

The first part deals with question No. 2:

Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain

and retain the services of highly qualified civilian scientific and technical personnel?

I believe the answer to this question is an unqualified yes. One of the difficulties is related to those referred to in question 1, i. e., that of obtaining competent direction for a program when military rank must be considered. The greatest difficulty is, however, in wasting time of scientific personnel in trying to educate a lot of persons in higher echelons who by their training cannot be expected to understand the program. There tends to be too much superstructure in a military organization. The ratio of workers at the laboratory bench to administrators is often too low.

There can be no doubt that the average scientist in the United States does not want to work full time for the military in peacetime. If he does he usually feels a sense of frustration because he feels, rightly or wrongly, that he is called upon to do a lot of unnecessary rush work which takes attention away from the main objectives. Sometimes military orders are issued to do things which make no sense from a scientific standpoint.

The next part which I would like to read to the committee at this point deals with question No. 5:

5. To what extent should the Department of Defense contract with nongovernmental institutions to carry on military sesearch and developement programs?

The Military Establishment has not become accustomed to use of contracts to perform research and development on whole programs. The Atomic Energy Commission has shown that this can be done but the placement of responsibility on the contractor must be greater than is usual in the Military Establishment. I do not believe the system will work if the present tight control of research contracts is continued. The contract method of doing research has some advantages in freedom to hire and fire and to pay salaries based on merit.

My answer to this question is, therefore, that much research and development can and perhaps should be done this way but that a fundamental change in philosophy would be required to make such a system work.

The next statement, Mr. Chairman, is a summary included at the end of a letter written by Dr. Robert Oppenheimer, director of the Institute for Advanced Study, Princeton, N. J.:

It will be clear from these comments that I favor contracts by the Department of Defense with nongovernmental institutions, with the one warning that these should be so undertaken as not to destroy or cripple the basic long-term functions of those institutions except in dire emergency. Universities can play a great part in furthering military research; but they should not sacrifice for this their work in basic study and training and teaching except at those moments and for those undertakings which are indeed decisive for the survival of the Republic.

The next statements are taken from a letter received from Prof. Norman F. Ramsey, of the department of physics, Harvard University. Under question No. 2 Professor Ramsey states:

In addition to the inherent difficulties, there are some characteristics of the military organization of research that tend to retard scientific development. One of these arises dominantly from the large size of the military organization and from the fact that enough delegation of authority is not provided to the laboratory directors. I believe that the members of many military laboratories find their work to be somewhat frustrating scientifically. This often arises from the delays in obtaining approval for new research programs as these requests for approval make their slow way through the military chain of command. This is in marked contrast to the situation, let us say, at my own university, where I can make very marked changes in my research program without seeking the approval of anyone.

A second difficulty is that the research work in most military laboratories tends to be excessively programatic with the programs often being assigned by higher authority. Since receiving your letter, I have had discussions with a recent graduate student who rejected a high-paying position in a military laboratory in favor of a much lower-salary university job. He stated that the dominant reasons for his choice were the excessive programatic character of the military research to which he would be assigned and his anticipated lack of research freedom in a military laboratory.

Under question No. 4 Professor Ramsey states:

I think the provision of a considerable amount of civilian scientific direction in a military laboratory is desirable. However, it is important that the best possible man be obtained to provide the direction. In general, a better man can be found if he can have assurances of a fair amount of scientific freedom.

Under question No. 5 Professor Ramsey states:

I believe that the Department of Defense should contract with nongovernmental institutions to carry on military research and development programs to a considerable extent and as far as appears advantageous. I believe that contracts with highly qualified individuals in nonprofit institutions in the long run are particularly effective provided the intrinsic interest of the research program is sufficiently great that first-rate individuals and institutions are attracted to it. On the other hand, I believe that a considerable amount of "in-house" research is required for the military services to be capable of providing suitable understanding and evaluation of research performed elsewhere.

The next statements were received from Dr. Thorndike Saville, dean of the College of Engineering, New York University. The statement supplied by Dr. Saville is concise and directed to the point we have raised by the subcommittee, and I should like to read the entire statement at this point.

1. There are certain characteristics in military organizations that militate against obtaining maximum effectiveness in a research and development program. These include:

(*a*) Rapid rotation of supervisory personnel.

(*b*) Inadequate salary scale for top positions.

(*c*) Undesirable working conditions which include, (1) redtape, (2) restriction on attendance at technical meetings, (3) poor facilities in many instances, (4) strangling accounting practices, etc.

These could, no doubt, be rectified, at least in part.

2. Items (*a*), (*b*), and (*c*) above all contribute to making it difficult to obtain and retain highly qualified personnel.

3. Any organization doing research for the military, must eventually report to the military to be certain that military needs are met. However, it would seem desirable to have the administrative group include both military and civilian personnel, so as to bring together the two points of view.

4. Research can best be handled by civilians, even in a military establishment. Final control and policy functions have to come under the military. It might be advantageous to have some procedure whereby quite large scale, expensive, or novel, projects could be appealed (either pro or con) to an appropriate office not in the Defense Establishment, to assure against bureaucratic prejudice or fixed notions.

5. It is believed that there are valid reasons for the Department of Defense to employ nongovernmental institutions to carry on military research and development programs. Reasons for this follow:

(1) Educational and industrial research organizations are more successful in obtaining and retaining the best personnel.

(2) Educational institutions should participate in the program both for their contributions to the program itself and to help train research personnel. It should be noted that the atomic-energy program started in the universities. Research is also usually conducted more economically in universities than by military establishments.

(3) Private industry should participate in the applied research and development program since they will have to produce the great bulk of the military material. Hence it would seem desirable to bring them into the program as early as possible so that they can contribute from their background of experience in production.

The next statement is from Mr. Norman A. Shepard, who is chemical director of the American Cyanamid Co., New York. Under question No. 5, dealing with the extent to which the Department of Defense should contract with nongovernmental institutions to carry on military research and development programs, Mr. Shepard states:

I believe it is clear from my comments that I believe our present military research is being well conducted and well coordinated. I am chiefly concerned

about getting and holding competent men in our military research centers. I have emphasized the noncompetitive salaries paid civilians and that the witch-hunt practices deter some from entering or staying in Government service. I also want to condemn the practice of pulling competent civilian scientists and engineers out of Government and especially military laboratories, and drafting them for purely military service where scientific competence is only slightly, if at all, used. Our scientists should serve where their efforts can best serve the country's interests.

Mr. Shepard also states with regard to the management of the military research and development:

I would comment unfavorably on the practice of rotation of military personnel, which is applied to scientists in uniform as well as others. Many of our scientists in uniform (usually officers) are transferred from important projects at military research centers or in staff jobs at the Pentagon, just because the calendar indicates that it is time to move (in the Navy, after 2 years; in the Army, after 3, I believe). Research and development suffer seriously from changes in personnel. Continuity of effort over a period of years by a team of scientists is of great importance to the successful culmination of a project.

The last letter, Mr. Chairman, is from Dr. H. Guyford Stever, associate professor of the Massachusetts Institute of Technology in the Department of Aeronautical Engineering at MIT. Dr. Stever states:

One of your questions concerns the desirability of the establishment of "a civilian organization to administer military research and development programs." For two of its services, the army and air force, Great Britain has such a system with which I became familiar during World War II as a scientific liasion officer at the London mission of OSRD. Comparing the operation of their system and ours and trying to find a clear-cut advantage of such a civilian organization in this country, I can find none. There are advantages and disadvantages to each system. Without going into details of all of them, I might mention that the British system sometimes placed complete responsibility for certain research and development projects to be carried by committees made up of members of several independent agencies, some on the military side, some on the civilian side. This is a serious disadvantage in my mind, for I believe committees, while they can coordinate, advise, and explore on paper, cannot effectively be responsible for the day-to-day operations of a research and development project. Such a project is more effectively the responsibility of a single organization with a single line of authority. While this is only one of many pros and cons, on balance, I am not in favor of a separate civilian agency.

Dealing specifically with the first question in your letter to Dr. Stever, he states:

You raised the question of the existence of "any characteristics inherent in military organization which are incompatible with the administration of an effective program of scientific research and development." While the present system has much room for improvement, it is today an effective system. Since World War II much progress has been made toward the creation of this effective system. For example, while funding is still on an annual basis, in program planning it has been recognized that research and development projects are almost always of longer duration; civilian advisory committees have found more important places; close relations have been established between private industry and nonprofit institutions on the one hand and the military on the other.

Dealing specifically with the second question in your letter, Dr. Stever states:

Another question bore on the subject of the tendency "to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified scientific and technical personnel." Considering just the service laboratories themselves, I think there is no question that the presence of two distinct and different groups, the scientific and the military, within one laboratory with the final authority vested in the military, creates a situation considerably less attractive to civilian scientists or engineers both from the standpoint of hiring and retaining scientists and of getting the best work from them. Military men

and scientists differ in personal goals and working habits; the rewards each are seeking are different. The most effective laboratories within the services are those with the least military dominance not only in matters of policy, programs, facilities, etc., but also in services such as transportation and housing. I believe, and this answers in part another of your questions, that research and development should be performed by civilian-run laboratories and that military support activities should be separated from them.

The next statements are taken from a letter received from R. E. Wilson, chairman of the board of Standard Oil Co. of Indiana, Chicago, Ill. His replies to the questions asked in your letter are:

(1) While there are inherent characteristics of military organization which tend to hamper an effective program of scientific research and development, I think the military are making real progress in understanding and overcoming these difficulties, especially as they get more and more technically trained men in the higher ranks. I think they appreciate the fact that rigid military discipline does not work well if an attempt is made to apply it to research personnel. Independent thinking and varied lines of approach are essential to proper conduct of research.

(2) It is difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel in a strictly military organization. I think contracting out much of the work, particularly that of a basic nature, is the best answer.

(3) I doubt the desirability of establishing a civilian organization to administer the military research and development programs. Even though the research might be done somewhat more efficiently, you would increase the difficulty of getting the military to really understand the new weapons, take pride in them, and get back of them. There is civilian guidance at the very top, civilian adsory committees on most of the major projects, and civilian competition in some of the fields of research. I believe a balanced approach is better than either a strictly military or a strictly civilian one.

(4) I think my answers to the above question pretty well cover this as well.

(5) I think the Department of Defense should contract with nongovernmental institutions for most of their basic research and for those development programs where industrial experience and background is more important than military experience and background. On the other hand, there are situations in which a military organization has an advantage, such as application testing and instances where there is extreme danger. I do not think that universities in general are a good place to carry out the applied type of research.

At this point, Mr. Chairman, we have three additional letters which are quite lengthy and which bear directly on the inquiries of the subcommittee. In the case of the first letter from Mr. W. F. G. Swann, director of the Bartol Research Foundation of the Franklin Institute, Swarthmore, Pa., I think it would be appropriate to read the answers to the five specific questions at this time.

Mr. BALWAN. May I interject at this point: With respect to the letter from Dr. Swann, rather than read the general statements it might be desirable to read only that portion of the letter in its entirety dealing with the answers to specific questions.

Mr. BREWER. All right. These are his answers to the specific questions which were raised in your letter to him, Mr. Chairman.

1. There can be such characteristics, and undoubtedly there are. However, they are not, in my judgment, a necessary adjunct to successful research. The Office of Naval Research is an outstanding example of the most favorable conditions of operation from the investigator's standpoint. Many problems attacked in collaboration with the Air Force have shown very successful coordination of effort, as have problems with some of the arsenals. What is important is that the administration shall seek to understand that in scientific endeavor surety of achievement cannot always be guaranteed, and lack of achievement in any particular problem is not necessarily the fault of the investigator or indicative of bad judgment in attacking the problem. Success is to be measured in terms of the overall achievements of a group of problems, where it frequently happens that the outstanding success of one particular endeavor can outweigh the failure of half a dozen others.

Again, while important progress toward success is sometimes attained in the lifetime, let us say, of a contract, the ultimate success may not be attained until years afterward. If one should measure success in terms of the achievements of any of the great pioneers of science and if he should measure it in terms of the day-by-day output of achievement, the comparison would probably present a very depressing picture, so that even the question of continuing the employment of a Newton after his first year of work might become debatable.

2. The answer to this depends upon the circumstances. Where the nature of the work is such that security conditions are very rigid, one is apt to find quite a number of people who desire to avoid investigation of their affairs, in spite of the fact that they may be perfectly loyal in the practical sense. I think the evidence for this condition is perfectly plain. A great many people undoubtedly have things in their lives which they would not like to have publicly exposed—things which had no connection whatever with their loyalty but which might become bandied about as part of an overall investigation. Of course, the present Oppenheimer situation affords an example of many such things.

Another less vital matter concerns the routines of procedure necessitated by operation under Government auspices. The scientist of old did very little in the way of organizing his financial affairs. Today, when the scientist is presented with a situation in which all sorts of different expenditures are cataloged in different ways, and when he has in these matters, a vague sense of responsibility whose limits are ill defined, he is apt either to become confused in his activities or, what is worse, to gravitate from the realm of an investigator to that of an executive, and sometimes a very poor one. Once this starts, the man of science becomes lost to the purposes for which he was originally chosen, and unfortunately there is a tendency for him to take a certain amount of pride in his activities and satisfy his conscience for lack of further production by an appeal to the fact that no longer has he time for scientific work.

3. I do not think that this is necessary, provided that the conditions as cited under (1) are met. However, I see no disadvantage in it, provided that the civilian organization chosen is absolutely free from politics, is widely representative, and is constructed with the avoidance of all cliques within itself.

4. The answer to the first portion of this question varies with the nature of the activity. I think it would be very difficult to make a separation in the case of researches having to do with nuclear fission or thermonuclear weapons. Of course, that same separation is possible is evidenced by the fact that a good deal of the work in these fields is unclassified and concerns fundamentals. However, a complete separation would, I believe, be impracticable.

With regard to the second portion of (4), I do not think that the research and development work need be under the supervision of the military commander in the case cited. I do think, however, that it is a good policy of the scientific personnel to try to interpret to the military organization the meaning of what they are doing. If the proper relationships are established in this manner, it is my experience that the military personnel are willing to go a long way in avoiding the kind of control which would be obnoxious and can even be incited to enthusiasm in the work. The great thing is that they should not be left in the nervous condition of being technically responsible for something with whose progress they are unacquainted.

5. This question has several facets. I think the Department of Defense should contract with non-Government institutions to carry on military research and development programs. Such institutions are already set up and operate on the basis of long experience. Moreover, their internal management, founded as it is upon the necessity of making ends meet, but not so subject to governmental investigations at every point, are apt to be able to operate with a greater overall efficiency than is the case with a Government agency.

With regard to the participation of private, nonprofit institutions, I feel that the situation is the same as that for the other nongovernmental institutions already referred to. In fact, I think such private, nonprofit institutions represent some of the most efficient agencies for furtherance of research of value to the Government.

With regard to the participation of private industry, here again certain participation is, I think, desirable, although one cannot generalize in this matter. Some projects are more suitable for private industry, others are more suitable for nonprofit institutions. There is something to be said for bringing private industry very firmly into the realm of research activities. Some of our great industrial concerns, like the General Electric Co., the Western Electric Co., etc., have learned to appreciate the significance of fundamental research and to support

it, even though the return is not immediate. They have learned to understand this situation—they have learned it through the happy circumstance that sometimes one major achievement in the scientific laboratory will produce a sufficient ultimate return to support the laboratory for all future time in idleness if necessary, and yet pay a good dividend to the company. It is not so easy for small concerns to be so broadminded. The very fact of their smallness increases the fear of expenditure in which every dollar does not face its immediate return. The spreading of research over industry would tend toward a good educational influence and might point the way to some kind of overall insurance of ultimate return in the case of groups of small companies.

With regard to the last question concerning "inhouse" research, I believe that such research is valuable. In the first place, if done independently, it exerts a control over the process of getting into a rut. Indeed, one of the great advantages of a certain amount of duplication of effort is to be found in seeking safeguards against an individual or group of individuals getting into a rut in which they labor continually along some path with no very clear reason to hope for ultimate success. They work hard and their consciences are justifiably satisfied. Frequently, however, a competitive spark from the outside can serve as a potent influence to give new life to the stream which would otherwise become stagnant.

Another letter which might be valuable to insert at this point in its entirety rather than to read it, is from Dr. George E. Valley, Jr., associate director of project Lincoln.

(The letter referred to is as follows:)

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
LINCOLN LABORATORY,
Lexington, Mass., June 1, 1954.

Hon. R. WALTER RIEHLMAN,
House of Representatives, Washington, D. C.

DEAR CONGRESSMAN RIEHLMAN: I thank you for your kind letter of May 26 in which you solicit my views on military research and development. After some consideration of the background of the questions which you pose, I have concluded that a reasoned account of what I would like to get across to you would take me more time to write than you indicate to be available. I believe, therefore, that the alternate procedure suggested by you, namely, that I be interviewed by your staff, would be more satisfactory. Meanwhile, I shall content myself with two brief answers to your questions.

1. You ask: Are there any characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development?

Answer: Yes, but there are equivalent conflicting characteristics in business and industrial organizations, and indeed in society as a whole. Consequently, these military characteristics, while usefully identified, must not be overemphasized. The scientist and the military man must live together; and each must learn to respect the other's special competence, and to exercise forbearance with respect to his foibles.

2. You ask: Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?

Answer: To some extent; but much more serious is the stultifying effect of civil service and the fact that superior men can get from two to three times as big a salary elsewhere. Also, few competent administrators would wish to be saddled with a senior staff, none of whom could be fired; or to put up with the other quixotic personnel policies of the civil service. The military merely add a little more confusion to an already confused situation.

3. You ask: Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?

Answer: It would not be desirable. The military must be in charge of the procurement of research. This question requires a much more elaborate answer than I can give now.

4. You ask: (*a*) Would it be feasible to organize military research and development programs in such a way that the technical activities capable of being performed by a civilian organization could be separated from those which are purely

military, such as support functions? (*b*) Where military support activities are necessary in connection with a research and development project, and such activities must be under a military commander, does it necessarily follow that the technical research and development functions must also be under direct military supervision?

Answer: (*a*) If you are speaking of individual laboratories or stations, the answer to this is in most cases "Yes"; it is in those cases also desirable. (*b*) Similarly, the answer to this is "No."

5. You ask: To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs? To what extent should private, nonprofit institutions participate? To what extent should private industry participate? How much "inhouse" research is required for the military services to be capable of exercising qualitative control over research and development conducted by outside laboratories?

Answer: To the greatest extent possible, omitting perhaps only such subjects as ordnance and meteorology for which we have no already established private industry. The work should be given to the best organization available without regard to its profitmaking status. In general, more original work comes from the universities; more orderly and thorough work from industry; but there are large exceptions to this, and both are needed.

On the subject of "inhouse research" by Government agencies, my own ideas have been changing. I tend more and more to believe that less and less of it should be done; the necessary technical awareness of the Government staff could better be maintained by the granting of sabbatical years for study and research at private institutions.

There are two other subjects which I wish you had brought up.

One concerns officers' salaries, which are too low to keep the good men; particularly the good men in the research and development branches of the services.

Another concerns the confused state of the classified technical literature which, since there exists no standard periodicals with firm editorial policies, is fast approaching chaos. How to fix this without coming into conflict with security policy is hard to see. Yet certainly it is wasting huge sums for us today—and in nonobvious ways.

Sincerely yours,

GEORGE E. VALLEY, JR.,
Associate Director.

Mr. BREWER. The last letter, Mr. Chairman, is from Dr. J. A. Stratton, vice president and provost of the Massachusetts Institute of Technology. It is extremely pertinent to the inquiry of the subcommittee, but it is rather lengthy and it might be desirable merely to call particular attention to the letter at this time, with the understanding that it will be inserted in its entirety, with the other letters received.

Mr. BALWAN. Mr. Chairman, I want to call the attention of the subcommittee to the fact that more than 50 letters were sent out to various scientists throughout the country. I should like to ask permission that that list of names be inserted at this point.

(The list of names is as follows:)

Dr. J. B. Austin, director of research, United States Steel Co., Kearney, N. J.
George P. Baker, Harvard Graduate School of Business Administration, Soldiers Field Station, Boston, Mass.
Lloyd Berkner, Associated Universities, Inc., 350 Fifth Avenue, New York, N. Y.
Bruce Billings, director of research, Baird Associates, Cambridge, Mass.
Dr. Robert B. Brode, department of physics, University of California, Berkeley, Calif.
Wallace R. Brode, Associate Director, National Bureau of Standards, Washington, D. C.
F. W. Brown, Director, Boulder Laboratories, National Bureau of Standards, Boulder, Colo.
L. C. Browning, Physical Chemistry Branch, United States Naval Powder Factory, Indian Head, Md.

Walker Cisler, president, Detroit Edison Co., 2000 Second Avenue, Detroit, Mich.
Ralph Connor, director, research laboratories, Rohm & Haas Co., Philadelphia, Pa.
Dr. S. D. Cornell, National Academy of Sciences, 2101 Constitution Avenue, Washington, D. C.
Hugh L. Dryden, director, National Advisory Committee for Aeronautics, 1724 F Street NW., Washington, D. C.
L. A. DuBridge, president, California Institute of Technology, Pasadena, Calif.
James B. Fisk, Bell Telephone Laboratories, Murray Hill Laboratories, Murray Hill, N. J.
H. T. Friis, director of research, Bell Laboratories, Holmdel, N. J.
David T. Griggs, institute of geophysics, University of California, Los Angeles, Calif.
Dr. L. R. Hafstad, Atomic Energy Commission, Washington, D. C.
Dr. George R. Harrison, dean, School of Science, MIT, Cambridge, Mass.
Dr. B. Haurwitz, chairman, department of meteorology, New York University, University Heights, New York, N. Y.
Dr. Lee Haworth, Director, Brookhaven National Laboratory, Upton, N. Y.
Capt. J. T. Hayward, USN, commanding officer, Naval Ordnance Laboratories, White Oaks, Md. (Washington)
Dr. A. G. Hill, director, Lincoln Laboratories, Massachusetts Institute of Technology, Cambridge, Mass.
Dr. S. C. Hollister, dean of engineering, Cornell University, Ithaca, N. Y.
Dr. W. V. Houston, president, Rice University, Houston, Tex.
Dr. F. L. Hovde, president, Purdue University, Lafayette, Ind.
Dr. R. D. Huntoon, National Bureau of Standards, Washington, D. C.
J. A. Hutcheson, vice president, research laboratories, Westinghouse Electric Corp., East Pittsburgh, Pa.
Prof. H. F. Johnstone, department of chemistry, University of Illinois, Urbana, Ill.
Webster N. Jones, College of Engineering, Carnegie Institute of Technology, Schenley Park, Pittsburgh, Pa.
Prof. Joseph Kaplan, physics department, University of California, Berkeley, Calif.
M. J. Kelly, president, Bell Telephone Laboratories, 463 West Street, New York, N. Y.
W. E. Kuhn, manager, technical and research division, The Texas Co., 135 East 42d Street, New York, N. Y.
Dr. C. C. Lauritsen, professor of physics, California Institute of Technology, Pasadena, Calif.
J. L. Lawson, research laboratory, General Electric Co., Schenectady, N. Y.
Dr. Lawrence L. Layton, Naval Powder Factory, Indian Head, Md.
Dr. Frank E. Lowance, Naval Ordnance Test Station, China Lake, Calif.
Donald H. McLaughlin, Homestake Mining Co., 100 Bush Street, San Francisco, Calif.
Rev. James B. Macelwane, S. J., dean, Institute of Technology, St. Louis, Mo.
Randolph T. Major, vice president, Merck & Co., Inc., Rahway, N. J.
Dr. D. W. Albert Noyes, department of chemistry, University of Rochester, Rochester, N. Y.
Dr. Murrough P. O'Brien, chairman, department of engineering, University of California, Berkeley, Calif.
Dr. Robert Oppenheimer, director, Institute of Advanced Study, Princeton, N. J.
C. F. Overhage, Eastman Kodak Co., Kodak Park Works, Rochester, N. Y.
Dr. K. S. Pitzer, dean, College of Chemistry, University of California, Berkeley, Calif.
Don K. Price, associate director, Ford Foundation, 655 Madison Avenue, New York, N. Y.
Prof. Norman F. Ramsey, department of physics, Harvard University, Cambridge, Mass.
Arthur E. Raymond, vice president, Douglas Aircraft Co., Santa Monica, Calif.
Comdr. J. O. Richmond (USN, retired), 2538 East Fourth Street, Tucson, Ariz.
Louis N. Ridenour, University of California, Los Angeles, Calif.
Dr. Robert F. Rinehart, Case Institute of Technology, Cleveland, Ohio
Dr. Thorndike Saville, dean, College of Engineering, New York University, New York, N. Y.
Dr. R. A. Sawyer, dean of the Graduate School, University of Michigan, Ann Arbor, Mich.
Glenn T. Seaborg, Radiation Laboratory, University of California

Norman A. Shepard, chemical director, American Cyanamid Co., 30 Rockefeller Plaza, New York, N. Y.
Dr. Sol Skolnik, Naval Powder Factory, Indian Head, Md.
Dr. G. B. L. Smith, Hamilton, N. Y.
Capt. Levering Smith, USN, White Sands, N. Mex., commanding officer, United States naval unit
Dr. H. Guyford Stever, MIT, Cambridge, Mass.
Dr. J. A. Stratton, vice president and provost, MIT, Cambridge, Mass.
Dr. W. F. G. Swann, Bartol Research Foundation, Whittier Place, Swarthmore, Pa.
Charles Allen Thomas, president, Monsanto Chemical Co., St. Louis, Mo.
Dr. L. T. E. Thompson, Norden Laboratories, White Plains, N. Y.
Dr. M. A. Tuve, Terrestrial Magnetism Laboratory, Carnegie Insitution of Washington, Broad Branch Road, Washington, D. C.
Dr. George E. Valley, Jr., associate director, Lincoln Laboratory, MIT, Cambridge, Mass.
H. S. Vance, chairman of the board, Studebaker Corp., South Bend, Ind.
Dr. Robert W. Van Dolah, Chief of Explosive and Physical Science Division, Central Experiment Station, Bureau of Mines, 4800 Forbes Street, Pittsburgh, Pa.
Dr. John von Neumann, Institute of Advanced Study, Princeton, N. J.
Dr. A. H. Warner, Office of Naval Research, 1030 Green Street, Pasadena, Calif.
Dr. William Webster, vice president, New England Electric System, Stuart Street, Boston, Mass.
Dr. James H. Wiegand, Southern Research Institute, San Antonio, Tex.
R. E. Wilson, chairman of the board, Standard Oil Co. of Indiana, 910 South Michigan Avenue, Chicago, Ill.
Dr. O. C. Woolpert, director of the Ohio State University Research Foundation, Ohio State University, Columbus, Ohio

Mr. BALWAN. In addition, it might be appropriate to comment here that although only about 15 have replied to the subcommittee's request for their opinions on research and developments, many others have been very generous in offering their time to consult with the subcommittee staff members at any time that would be convenient for both parties. In some cases it has been possible to talk with these individuals with the understanding that the discussion would be followed by a written statement to the chairman of the subcommittee.

When the staff received these letters it would be desirable to have them included. Several others have indicated that due to the pressure of their own business they would not be able to provide the subcommittee with their comments. Still another group indicated that they felt that a comment from them would not be valuable to the subcommittee, since they did not have any connections with the defense military research and development program.

I believe this completes this portion of the reading of letters.

Mr. RIEHLMAN. Fine.

Before we go off the record, Doctor, on behalf of the committee I want to express to you our sincere appreciation and thanks for coming down this afternoon and giving your time to the committee in this very important and helpful discussion.

I also want to commend each member of the committee for the interest they have certainly shown in this matter and the time that you have given in in sitting in on these hearings, and the very constructive approach and questions that you gentlemen have propounded to the witnesses. It is heartening to a chairman to have members who really respond to the committee's hearings.

This session, particularly dealing with research and development, has demonstrated a definite interest on the part of every member to do his share and contribute the very best that he knew how in developing every phase of this important subject.

The committee will meet again, of course, and if any of the members have any other suggestions of any other witness you would like to have called before the committee, certainly the Chair will entertain that and I would appreciate your getting in touch, if I am not right here—getting in touch with Mr. Balwan or Mr. Brewer if you have any additional information you would like to give the committee.

May I say this on the record, that if we do not call additional witnesses, as soon as the record is prepared I will direct the staff to start drafting a preliminary report which will be presented, as I suggested before—and that was off the record—to the members for their consideration, correction and adoption. Then we will get the committee together and decide where we are going to go.

Mr. LANTAFF. Do I gather this is the last witness we contemplate calling?

Mr. RIEHLMAN. At the present time.

Mr. MCCORMACK. May I have the record show how pleased we are to serve under such a distinguished and fair chairman.

Mr. RIEHLMAN. Thank you.

Mr. LANTAFF. I, as another member of the minority, add a tribute for the fine leadership of the chairman and the excellent work of the staff in the preparation of this hearing.

Mr. RIEHLMAN. I deeply appreciate the latter part of the statement. The staff worked diligently and hard, and I want to say on the record I am very proud of the caliber of men we do have on our staff and working with us.

Mr. LIPSCOMB. As a member of the majority I would like to join with the minority in their remarks.

Mr. LANTAFF. Doctor, you are certainly seeing a fine nonpartisan effort in your visit to Washington.

Mr. RIEHLMAN. I think that is true, certainly.

I must say this for my majority member, that I must pay tribute to you, Glenn, for your active work on the subcommittee since you have been on here and the manner in which you have taken ahold in every project we have been in; and the constructive way in which you have handled yourself. That is to a new member. I would say that and I have said it about the rest of the members, but I would like certainly to pay that special tribute to you.

Mr. LIPSCOMB. Mr. Chairman, this is the first project I followed all the way through and I would like to compliment the staff too on the well organized meetings they have held and the method of having the witnesses here and having the meetings proceed so uniformly fine. It has been a real experience for me as a new member.

Mr. RIEHLMAN. The chairman would like to pay a particular tribute to Mr. McCormack, who is a member of the full committee and one who has had a very vital interest in this program. He has attended every meeting of this subcommittee dealing with this matter, and has contributed tremendously toward developing information which will help greatly in writing a constructive report.

John, we appreciate your faithful and loyal support during the past 2 weeks the committee has worked on this subject. Thank you for your remarks, Mr. Lipscomb. I know the staff will appreciate it.

With all those fine remarks in the record, the committee stands adjourned at this time.

(Whereupon, at 5 p. m., the committee adjourned.)

APPENDIX

Statements Received From Scientists and Other Interested Individuals

Letter From L. V. Berkner

Associated Universities, Inc.,
New York N. Y., June 30, 1954.

Hon. R. Walter Riehlman,
Chairman, Military Operations Subcommittee,
Committee on Government Operations,
House of Representatives, Washington, D. C.

Dear Congressman Riehlman: I am enclosing herewith a memorandum in reply to the questions raised in your letter of May 27, 1954, concerning the organization of military research and development. I sincerely trust that this may be helpful to your study of this problem.

In view of the breadth of consideration which is invited in your letter, I have discussed by own knowledge of the problem rather fully before answering your questions specifically.

Sincerely yours,

L. V. Berkner, *President.*

Memorandum

June 29, 1954.

To: Chairman, Military Operations Subcommittee of the Committee on Government Operations, House of Representatives.
From: L. V. Berkner.
Subject: Organization of military research and development.

1. INTRODUCTION

The last war demonstrated that weapon superiority acquired by effective research and development can be decisive. Therefore, the importance of military research and development to our national safety in the face of a determined and ruthless enemy justifies the most careful planning toward its effective organization. The problem of administration of military research and development is relatively new because large-scale military research and development is new. Therefore, if present arrangements for management are imperfect or not suitable to maintain our progress well in the vanguard of the enemy, the failure does not reflect discredit or blame on our military organizations. Rather it reflects the development or our understanding of what forms of management of research and development will work, and what forms do not work, in light of accumulated experience with different kinds of organization. Before answering the specific questions asked in your letter of May 27, 1954, it may be helpful to outline the essential elements of our background of experience so that this experience can be used to guide intelligently future organizational efforts.

2. HISTORY

The history of United States military research and development divides into three main phases. The organization and the results obtained during each of these phases have been radically different. Therefore, we have already acquired much experience on the advantages and disadvantages, and above all on the accomplishments, of each form of organization, and it is worthwhile to review this history for the lessons it provides.

Phase 1. Prior to 1939.—Before 1930, research and development was not an important attribute of the military organization. The designs of military equip-

ment up to 1930 were based largely on rule of thumb, guided by field experience. Those few early major inventions, such as gunpowder, the gun in its various forms, steam propulsion of vessels, and the like, were the results of private invention adapted to military application after the potential had been demonstrated. Field experience led to material improvements. There were, of course, some exceptions, such as the development of gas warfare, but on the whole, highly technical solutions were not required for military effectiveness. Beginning about 1930, the injection of electronics into the military scene introduced the first really great need for highly organized research and development effort. Effective equipment could no longer be designed by the experience of the "man in the shop," and the need for highly skilled technical know-how and research became more pressing. During the period of 1930–39, military research and development was done primarily by interested bureaus of both the Army and the Navy. These bureaus operated a few laboratories, such as the Naval Research Laboratory, the Fort Monmouth Signal Laboratory, and laboratory facilities at Edgewood, Aberdeen, and Dayton. But on the whole, the principal military research activities were carried out by private contract under the military bureaus. The era was marked primarily by the conduct of research under rigid specifications similar to those used for the procurement of standard military equipment. These limitations permitted the injection of very few imaginative solutions. Moreover, even when effective research was done, there were totally inadequate means for transition of the resultant ideas and devices to military application and, consequently, research solutions did not find ready acceptance and utilization during the interval from 1930 to 1939.

Let me cite some examples. During this period, the development of radar was carried out primarily by the Naval Research Laboratory and the Fort Monmouth Signal Laboratories with the assistance of certain private contractors. While this development showed considerable imagination on the part of the laboratories concerned, it found very little acceptance in the Armed Forces. Consequently, on December 7, 1941, we learned that the transition from research to application was so poor that the commanders at Pearl Harbor were not even aware of the powerful protection that so simple a radar as the SCR–270 could provide.

Moreover, almost no thought had been given to the potentialities of airborne radar with its powerful capability for sea search, antisubmarine warfare, and fighter defense. Had the Catalina aircraft flying the search pattern from Pearl Harbor on December 7 been equipped with airborne radar of a type which could have been produced from NRL designs prior to that time, there is no doubt that the presence of the Japanese fleet would have been disclosed to our commanders at Pearl Harbor. (This elementary NRL airborne design was produced and used subsequently during the war with great success.) The development of airborne radar by the Naval Research Laboratory, although very primitive, had been entirely ignored up to the beginning of the war and certainly did not receive the encouragement justified by tactical need. Consequently, the first airborne radar sets for American aircraft had to be procured from Great Britain after the outbreak of hostilities and about 4 months before Pearl Harbor.

During the era before 1939, the introduction of adequate communication equipment into the Armed Forces had lagged woefully behind the general state of the communication art. As an example, at the beginning of the war, American aircraft were fitted with wholly obsolescent types of communication equipment. A careful study of battles such as the Battle of Midway shows how certain failures during these battles can be traced directly to the failure of primitive and obsolescent communication equipment. Consequently, only after the beginning of the war were our aircraft fitted on a "crash" basis with VHF communication equipment procured from standard commercial airline sources. (VHF equipment, and since the war UHF equipment have now become the standard of communications within the Armed Forces.)

The examples of radar and communications are only two of many examples which illustrate that our organization of military research and development prior to the war was completely defective. The character of these defects will be discussed subsequently.

Phase 2, 1939–46.—The opening of hostilities in Europe made it appear to many leading scientists in the United States that strong scientific support of our military operations had become imperative. The organization of the NDRC about 1940 and the subsequent Office of Scientific Research and Development grew out of a grassroots movement among the scientists themselves. Because of their intimate contact with the potentialities of science, these scientists realized that World War II would be critically dependent upon our ability to outwit the enemy with the quality of our military weapons.

The nature of the grassroots movement that led to the organization of the OSRD is worthy of study. I will cite two examples.

In 1939, Dr. Merle Tuve of the Carnegie Institution of Washington realized that nothing had been done in the field of air defense to compensate for the steadily increasing power of modern aircraft. Consequently, quite on his own initiative in collaboration with other scientists of his own and other laboratories, he undertook a study of proximity fuses for bombs and antiaircraft shells, which might increase their effectiveness by many times. As the study progressed, he consulted with the Navy Bureau of Ordnance's (then commander) Deke Parsons, who was appointed as liaison officer to study the proposal of the scientists. It might be added that the extraordinary ability of Admiral Parsons in realizing the potentialities of the proximity fuse greatly minimized the problems of its ultimate transition into the military field. As is characteristic of all imaginative projects, there was a good deal of resistance to this project on the basis that anyone who thought it was possible to put a radio transmitter and receiver with vacuum tubes in the nose of a 5-inch shell was generally crazy.

The second example is found in the development of microwave radar. A number of physicists realized that the (then recent) development of the "magnetron" offered the basis for the design of a radar having a very narrow beam width and high discriminating power. This would provide a radar that could "see" in much better focus. This development was initiated at MIT and organized under a division of OSRD known as the MIT Radiation Laboratory and led to the production of a variety of radars which became powerful tools for search, antisubmarine warfare, all-weather fighters, bombsights, etc.

We must not neglect to point out, however, that the already organized Bell Telephone laboratories also carried on very effective research and development in the field of radar under direct contract with the Armed Forces throughout the war. It might be said, however, that a substantial part of the effectiveness of the Bell laboratories' work was conditioned by the simultaneous work of the OSRD. Certainly earlier contracts with the Bell laboratories during phase 1 (1930–39) did not provide for the effective transition that was subsequently achieved during the war, since they had been unable to sell their commercial VHF communications equipment to the Armed Forces in spite of its adoption by the airlines. (This was the same VHF that was "crash-fitted" after the war's outbreak.)

The success of the OSRD was not restricted solely to its ability to recruit and organize original thinkers in science who were capable of translating their ideas into reality. It also involved two other major capabilities: The first of these was the ability of the OSRD to collaborate intimately with industry in bringing their early models into effective production. This also required the intimate collaboration of the Armed Forces. This collaboration was effectuated through large liaison offices in each of the OSRD offices, staffed with competent officers. These officers could advise and provide military information, and they were heard attentively. But they could not control the direction of research effort. This was an essential ingredient in OSRD's success. Quite aside from use of military liaison officers, OSRD also maintained civilian liaison representatives with military field forces to acquire a firsthand knowledge of military problems. The second was the ability of the OSRD to "sell" their ideas to the Armed Forces. This was done by a singular method which was almost uniquely successful. The OSRD usually found very great resistance to any new idea or weapon while it was in the process of development. The files are replete with statements of high military authority concerning these "ridiculous" ideas and, in most cases, these ideas would have been killed had the military been in control. One amusing case in the files is an order by the wartime "Cominch" directing the Navy to discontinue its interest in a certain OSRD development in which BuAer was collaborating, since in the view of the Navy this development would never have naval tactical application. This same development has subsequently become a mainstay of naval tactics and was recognized as such as soon as it could be demonstrated. When the OSRD was able to bring an idea or weapon to the point of demonstration and successful tactical test, resistance to naval weapons and ideas almost uniformly disappeared, and thereafter the idea or device met with great enthusiasm on the part of the Armed Forces. A profusion of examples on this point can be cited. In the case of the naval single-place night fighter, those naval men who worked closely with the OSRD in its development literally staked their reputations on its success. Early in the war, the idea of a night fighter operating from carriers was met with actual derision. But, as soon as experimental night fighters had been built and operated from carriers against actual targets, all resistance to their employment disappeared. Thereafter, night fighters

could never be produced fast enough to meet the enthusiastic requirements of the Navy. In this present day of complete acceptance of carrier-based night fighters, it is difficult to realize the resistance which was generated to such an obvious weapon during its development.

Almost every weapon devised from radical concepts that subsequently proved successful met with the same kind of resistance. Yet almost without exception, after these weapons had reached the point of demonstration, they received enthusiastic acceptance by the Armed Forces. The point is that radical and conceptual ideas must be developed outside of military control up to the point of experimental and tactical demonstration. I conclude that military research and development looking to naval or radical new weapons must be organized so that radical ideas can be brought to the point of demonstration before the military can rule them out.

A third example could, of course, be the development of the atomic bomb whose development was subsequently transferred to the Manhattan Engineer District. The initial experience and thinking toward the atomic bomb was initiated by independent scientists first independently and later under the aegis of the OSRD. In the case of the bomb, the major policies were established by the President himself.

The proximity fuse work, the radar work, other aspects of ASW, and many other lines of scientific endeavor were organized soon after the beginning of the war under the OSRD, with civilian-managed military research and development organization. The work of the OSRD was absolutely outstanding in introducing a wide range of new concepts and weapons into military science and tactics. As a consequence, military tactics were completely reformulated as a result of the power which these new weapons offered. There can be utterly no doubt that the OSRD was preeminently successful in bringing American military science to the forefront by the end of the war. Under this pattern, weapons were transferred to the military forces for production after they had been demonstrated and accepted.

Concurrently with the OSRD, the military organization continued its own research and development efforts. These efforts were directed primarily to the improvement of weapons based on the experience of our fighting forces. The efforts of the military forces in this field of improvement to existing weapons proved preeminently successful. As experience was acquired with the weapons in the field, defects in these weapons were rapidly eliminated and their performance improved. This work of weapon improvement was carried on as the almost full-time effort of the military laboratories and of the research contractors operating directly under the Armed Forces.

The success of direct military operation of research and development toward improvement and perfection of weapons is traceable to the ideas and pressures that emerge from the field and fleet operations. These field pressures produce the motivations to do really effective work on perfection of weapons. But no corresponding motivation exists to produce radical new weapons that the men of the field are not qualified to dream up.

Phase 3, 1946 to present.—Phase 3 of military research and development begins at the end of the war with the deorganization of the OSRD and the effectuation of the Military Defense Act of 1946. At the end of the war, Americans generally and scientists specifically looked forward to a period of peace during which military research and development would be deemphasized far below the level of wartime effort. Moreover, it was very doubtful at the time that the American people would support the wartime level of military research activity. Finally, scientists were anxious to go back to teaching and fundamental research, and there was serious doubt that an organization like the OSRD could be held together at a creative level. Consequently, action was taken to demobilize the OSRD.

The important part that science had played in creating military strength during the war was universally recognized. Therefore, in writing the National Security Act of 1947, the Research and Development Board was created by the statutory authority of Congress and provided with broad powers to advocate suitable and appropriate research and development programs. It was visualized that in this way the work of the OSRD would be completely undertaken by the military departments and that this would provide an adequate peacetime measure. Under the act, the RDB had no power to initiate research programs on its own. Their power with respect to new research was restricted solely to advocating appropriate programs to be carried on by the Armed Forces.

The RDB functioned through committees of civilian and military men in each of the major fields of technical specialty in which the military were principally

interested. Thus, there were formed committees on electronics, aeronautics, ordnance, geophysics, guided missiles, etc. The Board succeeded in doing an effective job in coordinating the research programs of the Armed Forces and eliminating much duplication. But experience showed that the Board devoted itself primarily to the perfection of existing weapons and relatively little to the advocacy of radical new military measures which science was capable of producing. This was not the fault of its civilian leaders, who were the most outstanding and experienced men to be found. The basic failure was due to defective organizations.

By 1952, it was widely recognized that the Board was not accomplishing the fundamental job of introducing radically new, conceptual ideas to the art of warfare. In retrospect, one can see that this was so for a number of reasons.

(*a*) The committees of the Board were organized in parallel with the bureaus of the Armed Forces, that is the committee on ordnance dealt primarily with the bureaus of ordnance of the Armed Forces, the committee on guided missiles dealt primarily with the service organizations responsible for guided missiles, and so forth. Therefore, the Board tended to be focused upon the same items that would normally occupy the attention of the military bureaus. Since the military members of the RDB committees were largely secured from the bureaus, they devoted their full time to the specialized items under their normal responsibility. They naturally influenced the committees to look primarily to the improvement and perfection of existing types of weapons. However competent the individual civilian scientists of the committees might be, they simply could not compete in ideas with the competent military members who spent their full time thinking about specific weapons.

(*b*) Under the organization of the Board there was no opportunity to bring together specialists from each of the various fields, such as electronics, guided missiles, aeronautics, ordnance, and so forth, to examine into the United States world strategic position with a view to seeing what new and radical types of weapons might improve our strategic power in the light of our current situation. This was attempted during the first year of the Board under a high-level policy committee, but the policy committee was abandoned after the first year of operation under the stimulus of the pressure for the improvement of existing weapons.

(*c*) Consequently, because of the demand by the field for the improvements, which the field could visualize, of military weapons in their own hands, and because of the lack of motivation to think about strategically important, radically new weapons, the emphasis of the Board was almost uniformly placed on weapon improvement. No thought was given to new strategies that radical or naval weapons would make possible.

Before tracing the reorganization of the Research and Development Board in 1952, we should turn to one other important development in the organization of military research and development after the war.

In 1950 the Navy realized that with the widespread introduction of the snorkel submarine, and with the imminent introduction of the nuclear submarine or of the hydrogen-peroxide powered submarine, the antisubmarine problem was getting completely out of hand. With great wisdom, Admiral Sherman, then CNO, asked the Massachusetts Institute of Technology to organize the Hartwell project. Under this project, the Navy requested that a group of scientists representing every conceivably related scientific discipline be brought together to investigate the entire problem of maintaining transport over the seas. The Navy asked that this be done without limitations by preconceived ideas, but that rather the whole potentialities of science be explored to determine whether in some way we could regain control of the submarine. The project was organized with scientists of very wide experience and from many disciplines. These scientists were thoroughly briefed on the entire strategic situation as it related to control of the seas, and no relevant information was withheld. Moreover, even when the scientists believed that they needed information that the Navy thought irrelevant to the situation, they were given this information.

Project Hartwell operated as a tightly knit group, turning these problems over and over again during a full-time study lasting many months. They were free to discuss these problems fully with one another in terms of their own particular specialty. They were free within the limits of security clearance to call in other specialists to illuminate other aspects of the problem. As the project progressed during the first 2 months, the problem appeared to be more and more insoluble and discouraging. But continued and continuous exposure to the problem forced some very unusual and fundamental thinking about it. Consequently, new

ideas began to emerge, and at the end of some months, the project reported it had produced several such outstanding military weapon concepts, based on new potential applications of science and upon new combinations of older ideas. As a consequence of this study, the Navy can now see its way clear to bringing the antisubmarine problem into hand.

This is not to say that the anti submarine problem is solved: but it is to say that using the ideas that emerged from Project Hartwell and the subsequent developments that were consequent to it, the Navy could now clearly keep the submarine under control if provided with the funds and trained manpower to produce and operate the appropriate equipment.

The operation of Project Hartwell (which was carried on under contract by the Department of the Navy) was reminiscent of the kind of creative work that was carried out under the OSRD. It established a pattern whereby science and the military, cooperating fully in peacetime, could produce strategically important ideas for the guidance of military research and the production of new military solutions. With close and effective liaison but under civilian scientific leadership, results of real worth were produced. The success of Project Hartwell led to the establishment of similar projects, including Projects Troy, Charles, East River, Vista, and finally the so-called Project Lincoln Summer Study. In the case of Project Charles, attention was devoted to the general problem of air defense. One very important solution was produced by Project Charles which was applicable to the local defense of our metropolitan heartland. But the whole problem of air defense against modern aircraft carrying nuclear weapons was so tough that the members of Project Charles could not see their way through to a solution of the whole problem.

This project did, however, stimulate thought on the problem of air defense which was integrated into the study of Project East River. During the conduct of Project East River early in 1952 new solutions to the problem of air defense began to emerge as byproducts of the civil defense study. The generation of these new possibilities led to the organization of the Project Lincoln Summer Study on air defense. This study was generally conducted along the lines of Project Hartwell, with the exception that it did not receive the wholehearted cooperation of the Armed Forces. For reasons known only to the Armed Forces, but generally characteristic of the generation of radically new ideas, many efforts were made to ignore or to suppress the findings of the Lincoln Summer Study and little effort was made to demonstrate how the ideas might work out. The difference between Project Hartwell and the Project Lincoln Summer Study lay in the fact that through rueful experience in the last war, the Navy knew it had a serious problem; the Armed Forces refused to recognize the serious state of the air-defense problem or to admit that it could be improved by radical measures. The negative attitude of the Armed Forces to air defense shows the wisdom of carrying on imaginative military research beyond their control, but also points up the need for insured liaison with them. Consequently, it was not until late 1953 that the President decided that continental defense was possible and should be pursued with considerable priority. The difficulty experienced by the Project Lincoln Summer Study was not in its ability to produce the effective ideas to correct our deficiencies, but rather in the lack of suitable means of translation of these ideas into military action.

One of the keys to the success of these projects lies in the access of the scientists to all pertinent information. Solution of a major military weapon problem seldom arises from some simple modification of a weapon. Usually the solution comes from some new or surprising development that leads to a substantial revision of our ideas of war. Therefore, to be conceived at all, the scientist must be admitted to and thoroughly understand all related possibilities. I might cite, as example, the invention or discovery of a new communication system that makes possible the arctic air-defense elements. This discovery emerged from a search for a solution to quite a different problem, but its value to the Armed Forces was recognized by scientists who understood the fundamentals of the air-defense problem so well that its application to solution of this problem was immediately recognized. Compartmentalization of information would have unquestionably permitted this important application to remain unexploited.

The experience that has been derived from the operation of these projects shows that important and radical new ideas bearing in a vital way on our strategic situation can be derived through the proper organization of highly trained scientists in liaison with highly trained and intelligent military men in consideration of broad strategic situations.

The failure of the Research and Development Board to achieve the primary objective of plugging strategic deficiencies with adequate weapon systems led to

its further reorganization under congressional authority in late 1952. It had neither the organization nor the power to expend funds directly for this purpose. At that time the Research and Development Board was abolished and replaced by the Assistant Secretary of Defense for Research and Development. This new Assistant Secretary of Defense was given additional power with respect to research and development problems, but still had no authority to initiate research projects directly. Research projects could be handled only through one of the Armed Forces. At the time of reorganization, I urged the Assistant Secretary of Defense for Research and Development to abandon the functional committee idea which had been held over from the Research and Development Board and to substitute either permanent or ad hoc committees to deal with broad strategic problems. I urged him, moreover, to bring these committees together for relatively long continuous periods of actual study on the part of both civilian and military members in order that they would be forced to think about these strategic problems in the same way that the participants on the earlier projects had been forced to think about them. This recommendation was based on the clear success that the projects had enjoyed, as contrasted to the failure of the Research and Development Board with respect to its important strategic responsibility. However, this change has not been carried out, and the older, functional-type of committee organization has been perpetuated.

3. MILITARY RESEARCH AND DEVELOPMENT RESPONSIBILITIES

From the foregoing discussion, experience shows that the responsibility for military research and development should really fall into two different classes. These classes are differentiated by the motivations that underlie their successful achievement.

Class 1.—The first class of research and development is research and development directed toward weapon improvement and perfection. This class of research and development is done superbly by the military forces themselves. They are under critical and constant pressure from the field to improve the weapons which the field knows and understands very well. Therefore, this type of research and development will always be done by the Armed Forces with prominent success. Failure of any bureau to respond to this motivation will ultimately force the replacement of those in charge of the bureau because of incompetence. It would be wrong to remove this research and development from the Armed Forces because under any other type of organization the direct motivation of field pressure would not be present. In my opinion the United States organization for the improvement and perfection of weapons is superior to the organization of the British Ministry of Supply for this very reason of direct motivation. (An official who does not respond to the requirements of the field would simply not be promoted.) Moreover, I believe that this type of research and development can be done most successfully under the present organization of service laboratories in which a civilian director of research functions under a military commander.

Class 2.—The second class of military research and development is strategic research and development directed toward radically new weapons and weapon systems, or tactical applications thereof, to correct a serious strategic deficiency produced by the power of an enemy. It is research and development toward developing new strategic alternatives. This type of research and development has never been done successfully under the direct control of the Armed Forces, and no single example to the contrary can be cited. All of the new weapon concepts that now produce important correction to our strategic deficiency can be traced to their initiation under the OSRD or under contract-operated projects since the war. This experience should be sufficient to condition us to the immediate abandonment of any further trials in this direction. The following observation of Admiral Mahan (The Influence of Sea Power on History) would seem particularly cogent:

> The unresting progress of mankind causes continual change in the weapons; and with that must come a continual change in the manner of fighting; in the handling and disposition of troops or ships on the battlefield * * *. Man will observe, also, that changes in tactics have taken place after changes in weapons, which is necessarily the case, but * * * the interval between such changes is unduly long. This doubtless arises from the fact that improvement of weapons is due to the energy of 1 or 2 men, while changes in tactics have to overcome the inertia of a conservative class; but it is a great evil. It can be remedied only by candid recognition of each change, by careful study of the powers and limitations of the new ship or weapon, and by a

consequent adaptation of the method of using it to the qualities it possesses, which constitutes its tactics. History shows that it is vain to hope that military men generally will be at pains to do this, but that the one who does will go into battle with a great advantage—a lesson of no mean value.

The motivation underlying the almost inevitable opposition of the Armed Forces to development of radical new weapons or tactics is worthy of study since it bears on the acceptable organization of research. Above all, a military man is a warrior; he must be the best fighter we can produce. He is taught to think only in terms of "fighting with what we've got." He must have the utmost confidence in the weapons at hand. He cannot rely on any excuse that he did not have weapons of tomorrow. Therefore, he is conditioned from his first lectures at the Academy to his last command to think of fighting in terms of fighting with what he has. This conditioning is a vital part of making him a good fighting man; if he lets his imagination run to new and novel weapons of the future, his confidence and reliance on existing weapons is shaken, and his effectiveness as a fighter is reduced. This aspect of training of good fighters has been recognized throughout history. It is, for example, stressed by Plato in his instructions for training the soldiers of The Republic. Consequently, a military officer of command caliber is quite correct in resisting thought about new weapons that subvert his fighting ability. Moreover, the Government reduces the fighting effectiveness of our forces by insisting that they think about such things. Only after weapons have been brought to the stage of successful demonstration can the fighting military man afford to consider their meaning in terms of reality. Therefore, I believe that resistance to radical or novel ideas is no accident; it is simply one of the marks of a good fighting man.

For what I would term "strategic military research and development" there must be established an organization independent of direct military control, with access to the necessary information and with close liaison with the Armed Forces, to generate ideas and the weapons hardware to prove out these ideas. Experience shows unambiguously that radical new weapons principles and tactics should be brought to the point of experimental demonstration before they can be safely turned over to the control of the Armed Forces for subsequent development or procurement.

The organization of such research and development must be under the entire control of a civilian scientific director. He must have access to the very best military advice and counsel and to all of the information that underlies the conception of weapons needed to correct strategic deficiencies. The laboratories under his command can be either Government-operated or operated by contract, although I believe that experience shows that in this area of endeavor contractor-operated laboratories are generally more successful (cf. MIT Radiation Laboratory, Applied Physics Laboratory, and the national laboratories of the AEC). If laboratories in this area of military research and development are Government-operated, they should be under civilian and not under military command.

Class 2 (strategic) military research and development might be operated either directly under the Secretary of Defense or as an independent organization such as the OSRD, but under no circumstances should it be under the control of the Joint Chiefs of Staff or any military organization. Generally such an organization should have the attributes specified in my remarks before the American Physical Society on May 1, 1953.

A research organization for new weapons systems must have certain requisites:

1. It must have full authority to initiate work on new weapons emerging from new ideas and directed toward the development of new and more effective tactics, capability for full understanding of the ideas to be explored, money, and the legal authority to act.

2. It must be able to deal with the military on equal terms and under circumstances in which the military are not held responsible for "any bad guesses that the scientists may make."

3. There must be intimate interchange with the military for counsel and advice as well as for operational evaluation, and transition to utilization.

4. The research organization should have access to the President, the National Security Council, and to top-level planning agencies of the Government, as well as to all information needed for its guidance in the selection of ideas to be developed. It must think of new weapon systems in a national, and not an intraservice sense.

5. It must have the confidence (and potential cooperation) of all areas of American science.

6. It must not be in competition for funds or authority with the regular programs of the Armed Forces for the improvement and operation of accepted and existing weapons.

7. The vigorous support and prosecution of programs toward development of radical new weapons must reflect favorably, and not unfavorably, on the careers of its staff.

To man such an organization, enthusiasts are essential. This does not mean that their ideas would not be tested and screened for fundamental limitations. But with this understood, we should let them go about their jobs with relative freedom. It was this approach that led the OSRD to its high measure of success. Significant inventions are not made by someone who knows it can't be done; they are made by enthusiasts. The modern inventor is the highly trained university or industrial scientist whose scientific experience leads him to see new horizons.

In particular, we must avoid the heavy, clammy hand of the permanent "committee." We must ask such men not, "Will you develop a gadget having such-and-such specifications?" but rather, "Here is the general situation. Here is access to all the facts you may need. What can be done to acquire or retain strength in this situation?" In creative development, new concepts must emerge from the realm of technology, and new gadgets assessed, before a specification is written. Specifications are principally useful for reproducing what has already been done; as a guide for future development they discourage and divert attention from the really new and important things.

Such a research and development organization could perhaps best carry out its functions through the contract mechanisms that have already proven their worth under the OSRD, the Manhattan District, and the AEC.

In addition to the planning staff and to the research and development organization there is a third essential element in an effective attack on our fundamental strategic problems, and that is a joint operational development group. By this I mean an operating organization equipped with airplanes, ships, guns, and all the facilities needed to develop and evaluate new tactics around new experimental weapons before they are completely emergent from the development stage. Here again are needed the same qualities of imaginative leadership that is required of the planning and of the research organizations. Such a joint group might be essentially military in character, and composed of military men and civilians with special skills. But it must be free of interservice competition, for new weapons should be given the opportunity to demonstrate what and how they can contribute to the overall military power of the United States rather than to the power of an individual military service.

I would emphasize that the fundamental contacts of class 2 (strategic) military research and development under contract operation should be with the universities or university-type nonprofit organizations. The success of both the nonprofit university-type organization, and of the Bell Laboratories in early aspects of strategic-type research, offers the clue to the basic requirements of such an organization.

(*a*) No civil-service redtape with advantages of the free-enterprise organization;

(*b*) Access to scientists with many and varied interests;

(*c*) No pressure to produce a military item that must be sold at a profit.

Such organizations have ready access to scientifically trained thinkers who have the most to contribute to the development of really creative ideas. This, of course, is not universally true, since the competence of such very fundamental research laboratories as the Bell Telephone Laboratory cannot be ignored. (But we must remember that the Bell Laboratories operate uniquely under a noncompetitive organization.) On the other hand, beyond the most preliminary experimental models, these university-type contract-operated laboratories should be encouraged to deal extensively and directly with industry to provide for the transition of their ideas into producible models. Here the model of industrial cooperation developed by the MIT Radiation Laboratory during the war can be followed in detail. The objective of the class 2 research and development should be the production of demonstrable experimental models, after which the responsibility for further specification and production should be transferred to the military organizations.

4. ANSWERS TO THE SPECIFIC QUESTIONS RAISED IN YOUR LETTER OF MAY 27, 1954

(*a*) Are there any characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development?

In view of the above discussion, the answer to this question cannot be an unqualified yes or no. The military organizations are not only wholly qualified, but are best qualified to carry on improvements and perfection of existing weapons, as outlined in class 1 of military research and development above. On the other hand, they have no qualifications whatever based on experience for carrying on class 2 (strategic) military research and development as outlined above. The fault of the present organization lies in the failure to differentiate between the motivations underlying the achievement of these two very different objectives. (When I say that military organizations are incompetent to conduct class 2 type research and development, I do not refer to the organization of the Department of Defense itself, which I do believe could be competent to supervise class 2 research under civilian leadership.)

(*b*) Does the military organization of a research development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?

As shown above, military organization of research and development not only tends to create conditions which retard class 2 type research, but generally renders it absolutely impossible. On the other hand, military organization is the most effective type to carry on class 1 type research.

(*c*) Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?

It would certainly be desirable to establish a civilian organization either inside or outside the Department of Defense to administer class 2 type research. For this purpose, military participation would be required to provide liaison, military support of test operations, and experimental tactical tests. It would be highly undesirable to establish a civilian organization to undertake weapon improvement and perfection under class 1 type military research and development since the present military organization is highly effective and efficient in this field, and I believe that a civilian organization would be less effective.

(*d*) Would it be feasible to organize military research and development programs in such a way that the technical activities capable of being performed by a civilian organization could be separated from those which are purely military, such as support functions? Where military support activities are necessary in connection with a research and development project, and such activities must be under a military commander, does it necessarily follow that the technical research and development functions must also be under direct military supervision?

It does not follow that military support activities of research and development projects require that the military research and development project be under military command. During the war, the military support of the radiation laboratory at MIT was carried on by separate military organizations under military command, such as project Cast and the Air Force flying project. These military supporting organizations were directed to carry on their operations in response to the technical and tactical testing needs of the laboratory. This command relationship proved most satisfactory without the need of an overall military commander of the radiation laboratory. Since the war, similar functions have been performed by the Air Force flying project and the Naval Air Development Unit in support of Project Lincoln, MIT. This form of organization of military supporting functions to civilian laboratories has been shown to be entirely successful.

(*d–1*) To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs?

Class 2 (strategic) military research and development can generally best be carried out by nonprofit and nongovernmental institutions in the initial, conceptual stages. The unusual success of this type of organization not only during the war under OSRD but also under the Atomic Energy Commission, as in the case of the Los Alamos Laboratory, the radiation laboratory at Berkeley, the Argonne National Laboratory, and the Brookhaven National Laboratory, attests to its extraordinary effectiveness of this type of research endeavor. There are, of course, exceptions to this, such as the outstanding fundamental research of the Bell Telephone laboratory. These nonprofit contractors should be encouraged to cooperate closely with industry for the quick transition of their hardware development into industrial production and know-how.

(*d–2*) How much "in-house" research is required for the military services to be capable of exercising qualitative control over research and development conducted by outside laboratories?

The class 1 (improvement and perfection) military research and development is adequate to provide the military services with the judgment necessary to write specifications and to the effect of the transition from class 2 military research and development to their own production control. Under no circumstances, however, should the Armed Forces exercise direct control over class 2 research.

It is important to realize that to carry on either class 1 or the transition from class 2 military research and development most effectively, the Armed Forces must indulge in a considerable amount of sponsored fundamental research and development. This is imperative to maintain their know-how in the field of science as it relates to the improvement of weapons and to the undertaking of the sponsorship of new weapons emerging from class 2 research. It would be a grave mistake to believe that the Armed Forces could escape from their responsibility of undertaking fundamental research and development through direct sponsorship, since their failure to do this would result in an increasingly ineffectual weapon improvement program.

UNIVERSITY OF CALIFORNIA,
DEPARTMENT OF PHYSICS,
Berkeley, Calif., June 14, 1954.

Hon. R. WALTER RIEHLMAN, N. Y.,
Chairman, Military Operations Subcommittee of the
Committee on Government Operations,
House of Representatives, Washington, D. C.

DEAR SIR: Prof. K. S. Pitzer has called my attention to your interest in the problem of the operation of research and development laboratories in the Department of Defense, and has suggested that I should write to you my comments on this subject. For your information I might say that I am professor of physics at the University of California, and was unit supervisor for research and development for the proximity fuse, applied physics laboratory, group leader, Los Alamos Scientific Laboratory and a member of the scientific advisory board, Naval Ordnance Test Station (chairman of board 1952 to present).

I am well aware of the difficulties that the Defense Department has in operating research and development stations within the military structure, and I believe that it is important that something be done to alter some of the existing conditions. Many of these problems are created in some measure by the unnecessary application of procedures and rules that have been found useful or traditional in regard to ships and yards, but which are inappropriate to scientific laboratories. The frequent rotation of personnel in important and policymaking positions places a considerable burden on the scientific personnel for the indoctrination and education of superior officers by subordinate scientists. The past experience of many of these officers has not been of the type that would prepare them to work with or deal with the problems of a scientific laboratory. The continued control of details of many of the developments from desks in Washington leads to difficulties in the development program. The long-range planning of research and development programs cannot be detailed in the same way that estimates can be made 2 years in advance of the supplies required for a ship or yard. With new discoveries and changing needs, the program 2 years from now may be in many phases unexpectedly changed. The economy measures which are appropriate for a business establishment may operate quite differently in a research and development laboratory. Restrictions on travel, telephones, automobiles, etc., may show decreased expenditures without decreased output in some business enterprises; but a research and development laboratory, where the output is not readily measured in dollars or units, may perform much less efficiently as the result of restrictions which were intended to improve the efficiency. Since so many of the difficulties encountered in operation of these laboratories arise from application of regulations that are made for quite a different type of establishment, that is the armed service itself, it seems probable that an improved operation could be achieved if much of the laboratory work were in a somewhat independent branch of the armed services. One could propose the creation of a Secretary for Research and Development who would have operating units in his jurisdiction. For the purposes of liaison, military officers would be assigned to these laboratories but not normally in positions of administrative responsibility.

I believe it is appropriate for the Government to establish research laboratories for the development of ideas and weapons for armed services. Some of these laboratories could be operated under contract to industrial concerns or universities; but I believe that they should be operated, for the most part, by the Govern-

ment itself. There will be a certain amount of development and troubleshooting necessary in each of the armed services, which can well be kept within the services; but this should be a minimum of activity and would not normally employ high-grade scientists for this type of service. One of the principal arguments for contracting defense research to institutions or industry is to avoid the Government regulations of civil service and accounting. In actual practice, however, a number of laboratories in the Government structure are not so hampered by Government regulations as are those in the defense services; and it appears that in many cases the regulations have been set up within the defense agency or interpreted by the defense agency so as to make operations more difficult than they necessarily need be.

Sincerely yours,

ROBERT B. BRODE, *Professor of Physics.*

UNITED STATES DEPARTMENT OF COMMERCE,
NATIONAL BUREAU OF STANDARDS,
July 13, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
House of Representatives, 1611 House Office Building,
Washington, D. C.

DEAR CONGRESSMAN RIEHLMAN: I appreciate the opportunity to present some of my views on the operation of scientific research and development programs in the defense program.

May I point out that the opinions expressed are my own, based on a number of years experience as a university professor, scientific war work, consultant and adviser to various defense projects and laboratories, administrative contacts with technical societies, and general civil-service activity both in and out of the Defense Department. The opinions expressed are my own and not those of the department or agency in which I am employed.

I am transmitting to you this letter and attached comments, through my Department, with a copy for their information and retention.

Sincerely,

WALLACE R. BRODE, *Associate Director.*

COMMENTS ON THE CONDUCT OF DEFENSE RESEARCH

INTRODUCTION

The military characteristics of "acceptance of leadership decision" and "discouragement of independent thinking and action" are an impediment to creative thinking and effective production of research and development in the military framework. Delegation of authority is possible but is seldom passed from military to civilian. However, it is not certain that the present military organization would not, with the right personnel and situation, provide an adequate atmosphere and location for an effective research and development program. The difficulty is to obtain this combination of circumstances. This may require a change just to insure the existence and continuance of such optimum conditions.

The military organizations tend to retard work and deter personnel from employment by its failure to continuously maintain an acceptable directional authority.

The problem of establishing the most efficient defense research organization requires compromise and acceptance of limitations by both military and civilian personnel and agencies. It appears possible to operate successful defense-research laboratories within the present defense structure, yet failures would indicate that a change of structure is necessary to insure a higher degree of success.

ORGANIZATIONAL STRUCTURE OF RESEARCH AND DEVELOPMENT LABORATORIES

Last year the Secretary of Commerce appointed a top level industrial and scientific committee to appraise the organization and operation of the National Bureau of Standards, which is one of the Government's leading physical research laboratories. This committee was headed by Dr. Mervin J. Kelly, the president of the Bell Telephone Laboratories.

One of the first items considered by the Kelly committee was that of the top organization and leadership of technical-research laboratories. They seriously

considered the structural organization involving the separation of the scientific and technical administration from the general administration and the relations of the laboratory with the Department. To quote the report:

"Under this suggestion the policy and administrative man would head the Bureau and the scientific and technical director would be subordinate to him. The committee considered this an unworkable proposal. In the academic and industrial areas of the Nation the leaders of scientific and technical organizations are substantially all scientists or engineers of high technical competence. They are aided in their nonprofessional management responsibilities by an adequately competent business administrator who is under their supervision. This common pattern has evolved from long years of service and there are compelling reasons for it. We are confident that it is also the best pattern for the Bureau of Standards."

While the Kelly committee was considering in the above quotation, the possibility of a policy and administrative rather than a military appointee to the administrative head, there is no reason to believe that the policy and administrative appointee would be any better or less prepared than the military appointee for direction of a research and development laboratory. In fact, the Kelly committee's conclusion appears to be equally pertinent to the military research and development laboratories. The responsibility for the administrative services under the technical director is indicated by the committee as a requirement for an acceptable research laboratory organization.

CIVILIAN-OPERATED LABORATORIES

Actual research in the last war was done primarily by civilian scientific organizations with military officer liaison where needed to provide the logical contact between research and the armed services. It would seem reasonable that the research and industrial production of defense materials should be a civil-defense activity with the commissioning of civil experts where they may be required to serve as liaison with armed branches in time of combat.

As an example of highly successful defense research in the war, one could point to the proximity fuse program which was civilian directed with a military liaison where essential. Such a laboratory could actually be operated under the present Department of Defense structure and need not be a contracted operation by other Government agencies, universities or industry.

It was a matter of considerable disappointment to many, that in the recent assumption of operation by different branches of the armed services, of civilian-operated laboratories formerly operated by nondefense Government agencies, that these were not established as civilian-operated research laboratories under the Assistant Secretary of Defense for Research, with a continuation of the same highly efficient and productive program, and the same attachment of military officers for technical liaison.

No fault was found or expressed in the organization or operation of these laboratories under civilian agencies, yet on transfer a complement of officers was assigned as a super direction echelon over the existing civilian direction.

So long as these officers are technically acceptable or serve only as figureheads and are rotated rapidly enough so that a figurehead position does not bore them, we may expect little interferences in the effectiveness of the program and the only loss is the extra expense of the military salaries. Direction and control of the program and research by an extra echelon of military personnel will undoubtedly and in fact in some areas has already resulted in inciting good technical personnel to leave defense technical laboratories.

LEADERSHIP REQUIREMENT

There is a major requirement of employment, which is probably greater in research and development work, as well as in universities, and applies to a lesser degree in business, and military operations; that the subordinate must have respect and confidence in his superior's comprehension, knowledge and ability to direct the program, or lacking this, the superior must provide a proper delegation of responsibility and authority to the technical personnel to conduct and direct the program.

Technical respect and confidence in leaders will promote the proper atmosphere for efficient research and development.

A scientist, and in particular an intermediate or top-level scientist, is generally concerned as to with whom and under whom he would work in a new position. If he does not know by personal reputation and knowledge these leaders, he is

apt to consult his scientific friends, major university professors and especially the published literature compendia of vita such as American Men of Science and technical society listings.

In the medical profession the officer head of a Defense Department hospital or laboratory is almost certain to be listed in the appropriate medical or surgical directories with indication of training, specialties, publications, special boards passed, and previous positions and responsibilities.

In the nonmedical defense research laboratories such a situation does not exist and the scientist can seldom find the military heads who direct the research in the technical society directories and in fact the military heads in many cases could not qualify for membership or listing in these societies or compendia. Sometimes these listings are accomplished after the fact so as to avoid embarrassment.

OFFICER TRAINING

The usual service assignment of military personnel in research establishments as operators or administrators is unnecessary and an impediment to research and development. It has been stated from time to time that the rapid rotation of military personnel through defense research establishments is to indoctrinate such officers in the administration and direction of defense research and development, so that in addition to functional comprehension in an emergency they would be prepared to direct such establishments. It would be less destructive to defense research programs to set up a separate indoctrination school for officers and leave the research program under a separate permanent technical direction. Such freedom from an added educational program and manipulation of their own research program by the students or trainees should improve the ultimate research and development production of defense laboratories.

Supply officers generally require long indoctrination to permit research workers to order small amounts by air dispatch in lieu of anticipating their needs in advance of the research program and purchasing in quantity. Research is not predictable in the sense that military operations are, and no complete list of materials is available for expected needs.

Programs are known to have been retarded by inability to obtain information which could have been acquired by long-distance phone but for which call the communication officer was unwilling to approve. Each new rotated officer arrives with thorough indoctrination of the printed regulations, which were designed for combat operation and not for the regulation of civil employees and communities engaged in research and development work.

ROTATION OF OFFICERS

The concept of rotation of military officers from combat units to research laboratories and civilian communities to serve as research directors, supply officers for research, city managers for civilian communities, and the like, may give these officers experience in these fields and an opportunity to try their ingenuity in solving the problems of such, usually without previous experience for such. Yet a far more efficient procedure with respect to laboratories and communities would be to utilize experts who had been trained for such work, rather than combat, and to retain such successful personnel to maintain a reasonable continuity in the laboratory or community.

Over a 10-year period, 1 of the large defense laboratories has had 6 commanding officers, 8 executive officers, and a corresponding shift of supply, personnel, experimental, and other officers—an average tenure of about one and a half years each. Many of these officers were assigned to the laboratory as their last position before retirement which in the armed services is generally at such a low age that retired officers seek other employment so as to have dual compensation of retirement and other pay. Rotating officers are often more concerned over their next assignment than over the one they hold. In some cases these officers endeavor to place themselves after retirement in top civil-service positions in the same organization in which they hold administrative control due to uniform. Without the uniform they seldom properly qualify for top civil-service technical positions and manipulations to achieve such status has a depressing effect on technical civil-service employees who have spent years in training at their own expense and additional working time to achieve qualifying experience.

There have been cases where undesirable commanding officers have failed to rotate with essentially the stagnation of the research laboratory program due to too long a period of administration which was incompatible with research. It would appear if the officer is better than average his tour of duty will be less than average, since he is more likely to be selected for other duty.

ROTATION OF SCIENTISTS

Research workers need training and experience just as do the military officers but each in his own sphere or technical area. Military officers attend professional activities such as war colleges, to hear and discuss operational and strategic problems. To the research worker his attendance at symposia and technical meetings is the equivalent, yet there is a marked reticence to allow them to participate in such.

Rotation of scientists for research study at institutions of higher learning, Government laboratories, or foreign universities does not, unfortunately, seem to be as important to defense research as such similar rotation is to the military officers.

While the suggestion of rotation of scientists may seem in contradiction to the complaint against rotation of officers, it should be kept in mind that rotation of both officers and scientists is recommended, but each limited to their sphere of capabilities, needs, and responsibilities.

It is felt that some officers have been rotated to positions beyond their needs or capabilities and that other capable officers serving as administrative assistants, and who have become indoctrinated to be useful, have been removed too rapidly. There should be a definite differentiation between the primary job and rotation for the secondary purpose of liaison, indoctrination, education and information. While in such secondary rotation, the service or responsibility should not be such as to disrupt the normal function of the agency or group to which the person is attached.

SCIENTIFIC OFFICERS

An attempt by the armed services to produce its own scientists, through the assignment of its regular officers to universities to take post-graduate training in atomic physics, bacteriology, or engineering, has not been too successful due to inadequate prerequisite courses taken some years before by the officer and inability to assimilate and keel up with the regular student who has been in a continuous educational program.

The alternative procedure to obtain trained technical officers is to commission and train as officers college graduates who have obtained their technical training. In general it may be said that it is easier to train a technical expert to be an officer than it is to train an officer to be a technical expert. In such areas as medicine it would not be expected that officers would be created by assignment of infantry officers to medical schools, nor would one assign on a rotation basis ordnance or air officers to perform medical operations or serve as commanding officers of medical units or research hospitals.

The lot, or status, of competently trained technical officers has been made harder by an apparent social and professional stigma placed on technical or engineering-duty-only officers by their fellow line officers, especially to those technical officers who are genuinely accepted by the civilian scientists as deserving of respect and under whom they willingly accept supervision.

CIVIL LABORATORIES IN THE DEFENSE DEPARTMENT

There does not appear to be any legal or administrative reason why the Department of Defense, or its separate arms, should not be capable of operating research laboratories in the same pattern as is now followed by such agencies as Agriculture, Commerce, Interior, or the National Advisory Committee for Aeronautics.

In the past there have been civilian heads to bureaus and offices in the defense areas (legal, fiscal, supply ordnance, etc.). There is no reason why a civilian employee in the Defense arm should be less in status for his position than a uniformed employee, nor why delegation of authority from the Department head to such an individual cannot be made. The disproportionate technical training required to achieve a certain position of research direction in civil and military lines, results in a marked discrepancy. The Defense Department actually uses additional civil-service classified procedures, over those used by nonmilitary agencies of the Government, and which appear to impede classification and discourage civil employment in defense technical laboratories.

OVERALL EFFICIENCY

A major concept, which is of greater importance in research and development work than in business and industry, is that a broad view of the whole problem is required to determine the level of operation of separate steps and that contribut-

ing steps, such as supply, communication, and fiscal, as well as technological steps, may be performed at what might be termed less than highest efficiency, so as to provide for a maximum efficiency and effectiveness of the final production within the time and performance limitations which may have been established. Excessive economy in funds, equipment, services, or personnel, at certain steps in the development or research process, may result in failure to achieve the end result which is desired.

ATTITUDE TOWARD SCIENTISTS AND CIVILIANS IN DEFENSE WORK

There is an apparent feeling of distrust and suspicion which pervades some military establishments regarding civilians and especially civilian scientists. Rather than trying to understand and aid in the scientific method of problem solution, there seems to be a direct effort to alter and suppress the scientific approach. There are many known cases where the administrative decision that the scientist does not have the "need to know" certain information has resulted in loss of time and needless duplication of research to achieve the same end results.

As an example of such difficulties one might cite the problem of participation in technical meetings and conferences. A special case is made of civilian scientists in attendance at scientific meetings and conferences which markedly separates them from military officers with respect to their freedom to attend such. In many cases the personal decision of the Secretary of the Department is required and while such action might be delegated, it generally is not delegated with respect to scientists, so that requests are generally denied at lower levels on a philosophy that if it requires higher approval then it should be avoided if at all possible. As an interesting example one might point to a recent national meeting of one of our most prominent scientific societies at which several hundred papers were scheduled in about 20 sections, and which papers were being presented on technical subjects by leading industrial, governmental and university scientists. To paraphrase briefly three cases at the meeting;

(*a*) Because of the large number of experts present, it had been the custom of one of the armed services to hold a classified symposium with some of its cleared consultants, since nearly all of them were there to attend the meeting. This armed service included in its sessions, by invitation, scientists from similar laboratories in other services. In one of these services, scientists were sent to the symposium but with instructions that they were not to listen to any scientific papers at the meeting since this would require separate travel approval for a scientific meeting, which approval was not available.

(*b*) At the same meeting another scientist was scheduled to give a paper and had submitted this paper in advance (it had been declassified and cleared by the proper authorities several months in advance). In ample time a request for travel to the scientific meeting was submitted but was denied either by superiors or by the Office of the Secretary. In connection with the project in which he worked, it was necessary to send him to an industrial plant near where the meeting was held at that time. He inquired as to whether he could take annual leave while in the East and if, when on annual leave, he could attend the meeting. It was decided that he could attend the meeting while on annual leave but that he could not give his paper even though he was present at the session.

(*c*) Also at this same meeting an employment clearing house was maintained by the society and a defense laboratory sent a scientist to interview and recruit new employees, but the scientist had to agree in advance that he would not listen to any technical papers since his travel authorization was for recruitment, which did not require top level department approval, whereas if he heard a scientific paper he would be attending a scientific meeting, which would not have been approved.

It is such limitations on purchase, supply, travel, library service, auto transportation and the like which often provide the spark to ignite a departure of a scientist from defense research work. It is difficult to understand why when the employee accepts security controls, working hazards, isolation and anonymity for most of his work, that the working conditions should be less desirable than in agencies and laboratories where such security controls, working hazards, isolation and anonymity are not involved, rather it would seem that there should be a working condition bonus rather than a penalty.

LACK OF CENTRALIZED AUTHORITY IN DEFENSE LABORATORIES

The separation of authority and cognizance in defense research laboratories is disturbing to morale and accomplishment. This separation applies not only to the programs but also to the maintenance and housekeeping functions.

The programs are generally parceled out by officers who maintain desks in the bureaus or offices of the defense areas in Washington. These officers, who rotate fairly often, determine which laboratory or industry shall work on a device within their cognizance area. Often the assignment is for a portion of the final product and with each change of rotation there may be a realinement of funds and projects.

Compartmentalization is even more a deterrent to effective research and development when the research involves more than one area within a service branch or the separate branches (i. e. Chemical Corps and Engineering Corps; Bureau of Ordnance and Bureau of Air; or Navy Ordnance and Army Ordnance.)

The armed services are compartmentalized with tight partitions running almost to the very top, not only between the services, but internally between medical, fiscal, supply, communication, transportation, personnel and many other functions, each of which has its own complement of personnel. In a conflict between the technical director, or even the commanding officer of a laboratory, and such assigned special function personnel, it generally results that the allegiance and response of the specialized personnel is to his own branch (where promotion hopes lie) rather than to the laboratory where he is assigned. In each of these specialized areas it becomes imperative that he operate his function at maximum efficiency, in strict conformance with the combat regulations of his service, rather than at a lowered efficiency at his level, so as to permit a higher efficiency at the final level of laboratory production.

Examples of such actions may seem petty in themselves, but as each cumulatively piles on the next to plague the civilian scientist or research worker, there often comes a breaking point where the worker leaves to seek employment elsewhere. In many cases the research worker has come to the laboratory from civil service in nonmilitary agencies of the Government and is particularly impressed by the added redtape or regulation which he realizes is not required by broad Government regulation but is specific to the armed service regulations.

SUCCESSFUL OPERATING CONDITIONS

The success of one of the major defense laboratories is ascribed to a considerable degree, to an enlightened Bureau which provided the laboratory with a Magna Carta which delegated operation of the laboratory to the civilian technical director and assigned, within the laboratory, military personnel only as liaison, unless especially technically qualified for direct reaserch or development work. The reversion to the more common pattern of defense laboratories could still be successful if the commanding officer of his own volition, delegated authority to the technical director, but the other form of operation provides no protection to the technical civilian, if it should be decided to place military officers in charge of each division and section, as is common in some defense laboratories.

The successful operation of some defense laboratories has been effected in spite of apparent impediments. For example, in one laboratory where funds were not directly provided for basic research, a broad view was taken, that research was a necessary component of development work, and a limited amount of the funds was applied to allied or related basic problems. Some of these problems were of a sufficiently broad character, that the research workers could report and publish the material so as to maintain or establish a technical reputation among their fellow scientists.

It was interesting in the choice of this basic research, that most workers chose problems closely allied to their assigned duties. In fact some of the most promising new developments in defense research have evolved from laboratory groups who did not have cognizant assignment to the specific problem that was solved.

GOVERNMENT RESEARCH LABORATORIES

It is important that the Government continue to maintain research and development laboratories as well as to continue both university and industrial contracted work. Contracted operation cannot, in the long run, replace the flexibility and effective production of a well staffed and operated research laboratory for the development of new and pioneering programs.

CONCLUSION

There must be a broader concept of assignment of working conditions, surrounding atmosphere, and regulations in research and development, than would seem to be essential in the combat areas where independent thought and action is not compatible with the ultimate objectives.

The newly assigned officer of a large defense research laboratory, moved from his battleship to the laboratory without sufficient indoctrination, and effectively depressed his civilian technical workers with the pronouncement that "running a technical laboratory is no different than running a ship."

DEPARTMENT OF COMMERCE,
NATIONAL BUREAU OF STANDARDS,
Boulder, Colo., July 14, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
House of Representatives, Washington, D. C.

DEAR CONGRESSMAN RIEHLMAN: This letter is in reply to your request of July 8, 1954, for my views on problems confronting our military research and development program. I am very glad to have this opportunity to contribute to this subject which is so vital to all of us. I will try to make the comments brief in accordance with your request. I assume that your concern is primarily with management problems, and I interpret your request to be for a statement of problems, and not for suggested solutions.

The subject of military research and development is a complex one and a short statement can hardly be adequate. I would, of course, be willing to talk with you and your subcommittee in as much additional detail as you might desire. The statements made below are my personal opinions based largely on my experience as a research worker and/or technical director of a large military research and development establishment, and are not reflections of views acquired in my present position.

I believe that the most critical problem in military research and development is to attract and hold the really high caliber scientific and engineering minds required in this type of activity. This problem is not unique to military research and development, but seems to me to be particularly acute in the laboratories under military management. In my experience, many of the basic difficulties in a laboratory under military management appear to be associated with having a mixture of professional personnel from two distinctly different career groups in which most of the key managerial positions are held by the group with the lesser tenure and the lesser training and experience in research and development. I refer, of course, to the professional military officer group and the professional scientist and engineer group.

I believe that the two principles in the military system which give rise to the most problems in a military laboratory are rotation of command and absoluteness of military command. Both of these principles are probably essential for a strong combat force, but, in my opinion, are singularly inappropriate in a research and development organization.

It is extremely important in an effective research and development organization to have a strong and respected leader who can give a feeling of purpose and professional security to the group, and is in a position to create an atmosphere which allows maximum expression of the individual creative talents. The essence of such an organization is flexibility and ability to respond quickly to need, with at the same time an underlying stability of basic policy and support. In an industrial or other civilian research laboratory, the director would normally be a technically trained individual who has made a career of research and development and takes on increasing managerial responsibility as his career advances. In a military laboratory, the director is normally a military officer who must of necessity consider his tour of duty there as a comparatively short interlude in his broader career as a member of the combat forces. In many military laboratories, there is an attempt to solve some of the problems by designating a civilian scientist or engineer as "technical director" or "senior scientist," who may have appreciable responsibility and authority in some cases. But since the military head of such an organization is required to exercise absolute command authority and responsibility in the military sense, it is difficult for him to delegate appropriately to a professional subordinate whom he has had no voice in choosing and about whom he may know very little.

To function under the military principles stated above, it is necessary to have a highly formalized structure with a large number of general staff groups in which the organization, operating policies and procedures, and the planning are suffi-

ciently standard in detail that they can be made to apply to any type of activity from running a ship to running a research and development organization. This allows the rotating managers of the various activities to shift from one activity to another with minimum disturbance. The other alternative would be to subject an organization to frequent changes of operating policies and procedures based on inadequate background with the attendant insecurity and instability. Neither alternative seems to me to be particularly appropriate to the requirements of an effective research and development organization.

There are other problems which I cannot take space to present here, except to mention the currently very much discussed problem of security regulations and their interpretation, which undoubtedly causes reluctance of a few highly qualified professional people to undertake classified military work. I assume that this problem has been discussed by others.

I have considered only some of the basic questions associated with the management of military laboratories, and have not touched on the very important problems associated with deciding what research and development projects should be undertaken, or on the whole field of consumer (combat forces)-producer (research and development laboratory) relationships. I repeat my willingness to cooperate in more detailed discussion and questions on these subjects and others related to military research and development, if you desire it.

Sincerely,

F. W. BROWN,
Director, Boulder Laboratories.

INDIAN HEAD, MD., *July 22, 1954.*

The Honorable R. WALTER RIEHLMAN,
House Office Building, Washington 25, D. C.

DEAR SIR: Dr. L. L. Layton of the Naval Powder Factory has suggested that I might wish to express my views with respect to the function of the military in scientific research. I have not had the experience that many persons from whom you have requested opinions have had, but have worked in the Government both under civilian and military supervision.

Both scientific and military personnel require specialized training in their respective fields. The scientist is in general not qualified to determine what types of weapons may be required by the military, while in general the military is not qualified to determine what detailed research is necessary for the production of these weapons. The placement of military personnel with little or no pertinent scientific training in direct charge of research and development seems to make no more sense than would the use of scientific personnel with no pertinent training in military positions. The scientist should be informed as to the general nature of the end product desired and allowed to work without the artificial interposition of military control when such control may affect adversely the time in which research objectives are achieved.

In many installations the ultimate authority for any action is vested in a commanding officer. This is as it should be where such installations are concerned primarily with military matters. However, in those cases where the activity is concerned with research and development, rarely is the commanding officer qualified by training to judge the best method or type of administration necessary to obtain maximum productivity, whether the product is in terms of pounds of powder or of increasing scientific knowledge for future use. In these cases the most he can contribute is to impede progress as little as possible.

It is probably necessary that research activities within, for example, the Navy be administratively under the Navy. Within a given activity, however, it seems that the functions of the military and the scientific staff should be parallel, with the military and scientific staffs having full authority within their respective fields.

The problem is obviously a very complex one, but certainly should be resolved on the basis of the most efficient obtainment of objectives. I believe it is a provable fact that the quality and quantity of scientific research is higher in those places where scientists are not under the direct command of personnel untrained in science.

Respectfully yours,

L. C. BROWNING,
Physical Chemistry Branch, United States Naval Powder Factory.

ROHM & HAAS CO.,
Philadelphia 37, Pa., June 8, 1954.

The Honorable R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Congress of the United States, Washington, D. C.

DEAR MR. RIEHLMAN: The questions raised in your letter of May 26, 1954 are most seeking and cover in an excellent way the basic problems before your Subcommittee. I have tried hard to prepare a well-organized statement in reply to your questions, but I have so many thoughts about them that it is difficult to present a coherent and brief letter. I think I can perhaps give you a better sense of my opinions if I write an informal letter in which I have taken the liberty of phrasing some different questions. I hope that the answers to these more general questions will suggest what my answers might be to your questions.

In the following paragraphs I shall speak of two different types of research and I should first tell you what I mean by these.

1. *Programed research.*—This refers to basic research, applied research, engineering design and all those experimental programs to develop new or improved weapons or materiel in existing fields; that is, intended to develop products for which there is a known use.

2. *Nonprogramed basic research.*—I have used this term to apply to the development of new principles and materials which are not necessarily intended to apply to existing fields of use. Many of the instruments of warfare which were used in World War II were based upon principles which were not developed in the quest for a weapon in a specific field. Indeed, the A-bomb itself is a good example of a weapon for which the armed services did not ask. It was necessary for someone else to develop the principles of this and tell them that such a weapon was possible. We cannot expect the armed services to predict all of the new techniques that will be available to them but must recognize that the development of these techniques must be left open so that new types of weapons can be possible.

The first question would be: "Assuming that it were possible to start with a clean slate, how would I choose to organize military research and development?" In answering this question I would like to restrict my answer to the first type above (programed research). For this type, I would set up laboratories in the appropriate military service with a military officer as the administrative head to whom a good civilian scientist is responsible on technical matters, but in making this arrangement I would pay particular attention to the responsibilities and relationships of the two key people.

I think the relationship of the scientific head to the military commander should be the same as my relationship to the president of our company. The military head would have the responsibility of integrating the research effort with other parts of the military establishment. He would not try to direct the research program but would depend upon the research director for technical guidance. I believe the reason why there is an impression that research cannot flourish under military administration is that the distinction between these two positions has not been clear. In the past, military heads have often felt that they must act to some extent as research director, and by virtue of their training and of the other demands upon their time have not been able to function effectively. Sometimes they have been people with more responsibility and more experience in production than in research and have attempted to apply the same techniques. I think that in the last decade there have developed officers who have a clearer understanding of the administration of research, and that it is unfair to consider that any past mistakes necessarily represent a permanent pattern.

One of the reasons I would choose to have this arrangement is that many military men are good administrators. As a matter of fact, on the average, they have better training for administrative work than do civilian scientists. Therefore, if they can maintain the proper perspective concerning their responsibility to research, having a competent scientific director of research to depend upon for research direction, this should be the optimum arrangement. Actually, it has been my experience that military officers could often expedite matters better than the civilian heads of Government bureaus.

The other reason why I would have this arrangement is the general principle that the person with the greatest incentive is the most likely to do a job successfully. The Ordnance Corps should have the greatest incentive to develop new ordnance weapons, the Chemical Corps the greatest incentive to develop new toxicants, etc.

The next question will be: "Who shall decide on the relative emphasis to be placed on various fields of research?" Military research, like industrial research,

should consider this one of its most important problems. The relative effort that should be put into research on aircraft, in comparison with research on rockets or improved foodstuffs, obviously requires a broad knowledge of the overall thinking in the Military Establishment as well as a technical estimate of what is required for success in various undertakings. I am sure the Government cannot afford to do all the research projects that could be justified. So far as military projects are concerned, it seems to me obvious that the overall responsibility for the distribution of effort must be in the Office of the Secretary of Defense. The recent creation of an Assistant Secretary of Defense for Research and Development suggests that there is a good possibility for having this overall planning.

The next question is: "Who has the responsibility for guarding against duplication of effort and for insuring the proper objectives?" For example, one might predict that the tactics of our most likely future enemy feature the willingness to expend considerable manpower, and that antipersonnel weapons may be more important than weapons to penetrate concrete and armor, which were most important in the last war. I would assume again that it would be the responsibility of the Department of Defense, probably through the Assistant Secretary of Defense for Research and Development, to make sure that such objectives characterize the various research programs, to make sure that no undesirable duplication exists and that there are no serious gaps in the program.

The next question is: "How shall nonprogramed basic research be carried on?" If I were responsible for the military program, I would want to concern myself only with research dealing with the program relating to military materiel now visualized. I would want to see that research was underway which might lead to completely revolutionary weapons, but I would feel that this would require the attention of someone not directly concerned with military matters. Actually, this is research of a type which one cannot very well plan to undertake, but which comes about as the result of ideas of scientists working throughout the country on all manner of problems. I would suggest that perhaps within the objectives of the National Science Foundation one might place the support of work which might lead to the development of new principles which might be applicable to miliatry materiel, but which research is not definitely directed toward a specific field of application.

The next question would be: "What is the place of an independent civilian agency to do work on military problems?" I do not think a permanent agency of this type is a desirable thing to have. It seems to me that for a continuing program, the arrangements proposed above are likely to be more satisfactory. However, if there comes a time where the all-out mobilization of the country's resources is required, an agency of the type of OSRD might find a useful place. I believe an agency of this sort could expand faster and contract faster than any of the regular Government functions; furthermore, in all-out mobilization, scientists would be willing to leave civilian jobs to work temporarily in such an organization, and I believe it would likely be staffed with more able people than could be attracted to a permanent Government organization. During the last war, OSRD could attract men like Bush, Conant, Richards, Adams, Tolman, etc., but I cannot imagine that this type of talent could be obtained for a permanent Government organization.

The next question is: "What types of work should be carried on in Government laboratories and what types under contract with industry?" I want first to say that I believe most industries have some sense of civic responsibility and will be willing to undertake projects important to the national defense. It is, however, appropriate to consider what it is fair to ask them to do. In a case of all-out emergency, one can be free to go to industry for any urgent job, but this is not appropriate to do in a situation which may last for decades. When an industry is asked to undertake a research job, it means that either it must hire additional men (with some uncertainty about continuing Government support for them), or it must sacrifice the results which it would obtain from the efforts of men who would now be diverted to Government work. There are probably instances of companies who become overextended in research and are anxious to find outside support but these are generally not the companies where you will expect to get an efficient research job carried out. I believe it would be feasible to ask industry to undertake two types of research projects and that others could be handled in Government laboratories.

(*a*) Research, usually of the application type, which is likely to lead to commercial sales by an industrial concern.

(*b*) A research program which is expected to be of a continuing character and can justify an industry in acquiring additional employees to undertake this work.

Perhaps I should give an example of the latter situation referred to above. This also has some bearing on your fourth question concerning the separation of civilian functions from military functions. Our Company has organized for the Ordnance Corps and is operating for them a Central Research Laboratory on rockets. While we operate on an annual contract basis, research in rockets is expected to be a continuing program of the Army, and this is, therefore, something for which we felt justified in acquiring a skilled staff to do this particular job. Our employees work in buildings which are the property of the Ordnance Corps, physically located within Redstone Arsenal, which is under command of an Army officer. We charge a $1 fee for this operation but are willing to perform this civic duty because it is set up so that we do not expect unreasonable fluctuations in the effort we are expected to make. I might add that, while the presence of a civilian and a military establishment on the same grounds is not completely without its problems, I believe the arrangement has worked in a way that is mutually satisfactory, and I believe that we are actually better off to have a military man in charge of the entire establishment. It has operated in such a way, however, that we have been essentially responsible for the technical activities.

From the questions you have asked, it is obvious that you have a major concern as to whether there is anything fundamentally wrong about military control over research. I think there are probably some prejudices on this point, but as I have indicated, I see no difficulties with them so long as the proper relationships are maintained. So long as good scientists work on a good program under conditions conducive to good scientific work, it makes little difference what the organization is, and the proper head, whether civilian or military, will make this work effective if he has the right support. I believe that most scientists who are worried about military control are comparing military establishments with the best civilian laboratories. Actually, this is not the comparison which must be made; the comparison should be between Government laboratories operated by civilians and Government laboratories under military control. *It is my impression that the main deterrent in hiring men for Government work does not have a relationship to whether the control is military or civilian; I think the main obstacle is in hiring people for Government work.* Events of the past few years have not tended to make people feel that in working for the Government they can necessarily be proud of the fact, because there seems to be a good bit of sentiment that many Government employees are not necessary or are not giving faithful performance. In addition, scientists who have read of the incidents concerning Condon, Astin and Oppenheimer—even if they may not have an opinion about these specific men—are not confident that they can receive gratitude and just treatment as a reward for devoted work. For this reason, it may be desirable to increase the amount of work which is done under contract. Aside from this, the most important contribution to obtaining competent scientific personnel will not depend upon whether administration is by civilian or military but will depend upon making prospective employees feel that they will enter into work which is important and respectable and which will be appreciated if done well.

I hope that these thoughts will be of some value to you, and if you wish to send a member of your staff to talk in more detail about the specific points you raise, I shall be most pleased to meet with him. It is very important that we achieve the best possible arrangement for our Government research. I am especially pleased at the type of questions you asked because of the extent to which they show that your committee has an appreciation of the real nature of the problem.

Very truly yours,

RALPH CONNOR, *Vice President.*

WASHINGTON 8, D. C., *June 14, 1954.*

Hon. R. WALTER RIEHLMAN,
House of Representatives,
Washington, D. C.

DEAR MR. RIEHLMAN: Your letter of May 27, 1954, asked me to comment on five questions that are among those on which the Military Operations Subcommittee of the Committee on Government Operations is conducting an inquiry.

I am sorry that my reply to your letter has been so long delayed. The whole problem raised by your questions is one for searching and informed analysis; for a time I was inclined to say that I could give you no more than a superficial reply in the time you suggested, and therefore to beg to be excused from any substantive answer. But it now seems to me that I have a few comments that

may be of some pertinence; I send them, below, with full awareness that they are by no means fully responsive to your questions.

1. That characteristics inherent in military organizations are not necessarily incompatible with the administration of an effective program of scientific research and development seems to me clear because many such programs are being administered effectively in military organizations in the United States today. On the other hand, I believe that there are characteristics of military organizations that call for special consideration when the administration of research and development is planned if such work is to be as effective as possible.

One such characteristic is that of the command structure of military organizations. Effective research and development are not to be expected in general under a system that insists upon accomplishing its aims by precisely formulated orders flowing from echelon down to echelon and by rigidly limited and channeled responses flowing back upward. Another characteristic of military organizations that can be inimical to effective research and development is that of regular and arbitrary turnover of personnel. There are excellent military reasons why rotation of military personnel is desirable. But research administration of sustained effectiveness requires continuity and a kind of training remote from the usual training of military officers. Flexibility in rotation is desirable for those administering research and development programs so that when an effective administrator is found, or has been trained on the job, he can be kept on the job for a reasonable time.

There are undoubtedly other characteristics usually associated with military organization that are not suitable to research and development organizations.

However, experience has shown that even within military organizations such characteristics need not apply to research and development programs, or can be modified in their application. Given understanding by military personnel of the requirements of effective research and development administration, there appears to have been no inherent obstacle to the meeting of those requirements. This is not to say that they have always been met, by any means, but there are examples of their having been met in large measure.

2. The answer to the second question cannot, in my mind, be given categorically. Poor organization of research and development in the military services can certainly create adverse conditions for effective work and for effective recruiting of scientists. But this is true of other environments as well, and I do not believe that military establishments must inevitably organize research and development poorly. Properly organized, a military research and development program probably does not face any greater problem of effectiveness or of recruiting than would the same program under other Government auspices with similar pay scales, living conditions, and so forth.

3. I assume that this question refers to an organization like the Ministry of Supply in the United Kingdom. Fifteen or twenty years ago in the United States a free and reasoned choice might perhaps have been feasible between the two systems—that in which each military service carries on the research and development it needs, and that in which responsibility for all military research and development is assigned to a separate civilian establishment. Today I doubt that it is wise or realistic to consider the second alternative. The first is in full operation, and it seems to me more fruitful to consider what may be its shortcomings and how to remedy them with a minimum of basic change rather than to suggest a revolutionary change of the entire system.

I am inclined to feel that one of the major defects of the present system lies in the necessary preoccupation of the military services with short-term problems—the requirement of day-to-day readiness of the fighting forces. This inescapable responsibility focuses military thinking on the improvement of present weapons, either through quick-fix remedies for defects as they are uncovered or through a more of less steady evolution of improved designs without basic change in weapons concepts. The military services themselves have recognized this difficulty and have taken steps to counteract it through the establishment of groups, from time to time, that are specifically charged with forward-looking thought and planning with regard to weapons.

But it seems to me that there is still room to consider whether a civilian-led research and development organization on a small scale, charged with research on fundamentally new weapons, responsible for bringing free and imaginative thought to military problems, and equipped to explore the resources of science for new approaches to such problems, might be profitably added to the research and development activities of the Department of Defense as they are carried out today.

This is not a new idea. of course; it has been proposed before and discussed extensively. To my mind its success would depend strongly on whether it could be organized so as to have adequate freedom and at the same time have full access to military operational and weapons thinking, and full cooperation from the military services. But its success would depend even more on the quality of scientific leadership and scientific staff that could be attracted to it. Possibly it could best operate largely with individuals recruited on a 2- or 3-year basis on leave from industrial and academic organizations.

What I have described is very different from a Ministry of Supply and also from an OSRD. The Ministry of Supply carries on substantially all British military research and development in many fields. The OSRD accounted for perhaps 20 percent of the total military research and development of the United States during World War II, and was a completely independent organization reporting direct to the President. The kind of civilian organization I have described would be within the Defense Department, reporting I should think at the Assistant Secretary of Defense level, and would have funds amounting to perhaps 1 percent of the total military research and development budget.

In such an organization full military cooperation would be essential; military participation would be desirable, but not as a controlling influence. The essential characteristics of the organization would be freedom to select its problems, freedom to think unconventionally about them, and freedom to explore solutions having, perhaps, a small probability of success but promising a large payoff if successful. The group could well deal with both long-term and short-term problems, as long as they were truly critical problems. The freedom to risk having only a small percentage of successes, in the interest of achieving the really big successes, would distinguish the group from the great bulk of research, development, and engineering ordinarily carried on by the military services.

4. There are cases where the separation described in this question appears to have been made successfully. Research and development do not have to have direct military supervision just because they require military supporting activities. Even in a military establishment having a military commanding officer it is possible for scientific programs to be under civilian scientific supervision without untoward interference stemming from military command and support functions. To achieve this, however, calls for a degree of understanding and flexibility at all levels, from the military department to the laboratory, that is not always present.

5. It is my impression, based on information now nearly 2 years old, that at present about 60 percent of military research and development is carried on by industry in the United States, about 10 percent by nonprofit institutions, and about 30 percent by military laboratories. To have some such division seems to me highly desirable, although I see no way of concluding that this particular division, or any other, is the optimum one.

It is important, in my mind, that a considerable amount of in-house research be done by the military services, for the reason stated in your question. Also, in certain fields of limited civilian interest, in-house military effort may be necessary simply to get the research done. But to staff the military establishments to do the entire job would be impractical; and it would be unwise because it would insure that military research and development would be out of touch with civilian research and development, with damaging consequences to both.

The great reservoir for the bulk of the work is the industrial laboratories. Perhaps a good case can be made that at least half the work, at present levels of total effort, should be done there because apparently that much can readily be absorbed there.

The universities and other nonprofit institutions represent a resource of exceedingly high-quality personnel, and every effort must be made to use it wisely. I believe that it performs its most useful function when it is drawn upon for work that has a high admixture of research, as contrasted with development, and for objective scientific advice on broad problems. I believe that to be generally the way in which nonprofit institutions are being used in military research and development today. I do not see how their participation could be greatly increased without danger to their teaching, their free research, and their other primary functions which are of extreme importance to our future scientific development.

Thus while I believe that the present distribution of military research and development between Government, industry, and nonprofit institutions could be changed, as indeed it now varies greatly among the three military services, I do not know of any reason for supposing that a different division, within practical and reasonable limits, would be either better or worse than the present one.

I should of course be glad to discuss these matters with your staff if you wish me to.

Sincerely yours, S. D. CORNELL.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS,
Washington D. C., June 9, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Washington, D. C.

DEAR MR. RIEHLMAN: Your letter of May 27 is acknowledged. I will be glad to assist your subcommittee in any way possible. My experience has been entirely with the civilian scientific research agencies of the Federal Government, 29 years with the National Bureau of Standards and 7 years with the National Advisory Committee for Aeronautics. Since 1944 I have been a member of the United States Air Force Scientific Advisory Board (originally called Scientific Advisory Group). This group has given much attention to the matters under consideration by your committee. I enclose herewith a copy of a talk given to students at the Air University on January 10, 1947, which deals with science and the Air Force. My views are essentially the same today; however, it should be recognized that the Air Force has made considerable progress since 1947 and hence some of the discussion is not pertinent to the present situation. Improvement is still possible.

With reference to your sample questions, much of the discussion in the enclosed paper is still applicable. The following brief comments may be of assistance:

1. I do not believe that there are characteristics in military organizations which are incompatible with the administration of an effective program of scientific research and development, but there are characteristics of both military and scientific organizations which give rise to difficulties which can be overcome only by mutual understanding. These are discussed on pages 7–9 of the enclosed paper.

2. There are some aspects of the present military organization which make it difficult to obtain and retain the services of highly qualified civilian scientists. Many of the difficulties could be removed by administrative action. Some of them are discussed at various points in the enclosed paper.

3. The establishment of a civilian organization to administer military research and development programs would solve some problems and create others. I believe a distinction must be made between basic and applied research for advancing science and technology and research and development on specific weapons. The National Advisory Committee for Aeronautics, an independent civilian agency, has performed the first function in aerodynamics, structures, propulsion, and operating problems since 1915. The military departments and the aircraft industry have expressed general satisfaction with the results. I do not believe that a civilian organization should be set up for development of specific weapons.

4. An arrangement similar to that described is given at the bottom of page 11 and top of page 12. There are military laboratories of this type which are quite successful. I might interject that I believe that the success of a scientific laboratory depends more on the quality of the scientific leadership, whether civilian or military, than on the form of organization.

5. These questions require further study. I am not in a position to answer them.

In conclusion, I wish to emphasize that the views expressed are my personal views, and not those of the National Advisory Committee for Aeronautics. The executive committee has had no occasion to discuss the administration of research programs other than those under its control.

Sincerely yours,

HUGH L. DRYDEN, *Director.*

CALIFORNIA INSTITUTE OF TECHNOLOGY,
Pasadena, July 1, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee of the Committee on Government Operations, House of Representatives, Washington, D. C.

MY DEAR MR. RIEHLMAN: This will be an attempt to reply to your letter of May 27 concerning the operations of scientific research and development programs in the Department of Defense.

The problems which your committee is facing are very deep and difficult ones and the questions proposed in your letter are good examples of the difficulty. These questions show that your committee has already given much thought to this problem. However, they are questions to which one cannot give "yes" or "no" answers.

I shall try to discuss in turn the specific questions which you raise and then make a few general remarks

I will answer questions 1 and 2 together. These questions are:

"1. Are there any characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development?

"2. Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?"

One may be tempted to give a flat answer of "yes" to each of these questions, but the undeniable fact is that there have been effective scientific research and development programs carried out under the military services. There have also been ineffective programs. There have also been both effective and ineffective civilian scientific research and development programs. In fact, only rarely has it been possible to bring together exactly the right combination of favorable factors to create, under any auspices, an outstandingly successful research and development enterprise. Such an enterprise is a delicate flower and it flourishes, not automatically by eliminating unfavorable conditions, but only when very special efforts are made to insure that all conditions are favorable.

If, in place of question 1, we ask whether the military organization is one in which we can be sure that all the positive conditions necessary for an effective research and development program are automatically satisfied, the answer must be "no." Yet it is this positive question that must be faced. The question is not how to prevent failures, but how to insure success; or if success cannot be positively assured, then how can one create those positive conditions which will give the largest chance of success?

This leads to the most difficult problem of all; namely, What are the factors which provide a positively favorable atmosphere for a research and development enterprise? There are, of course, many:

1. The research program must be interesting and challenging.
2. The need for the solution must be apparent and real.
3. The leadership must be superb.
4. The working conditions must be positively attractive.
5. Great freedom must be provided for individual initiative and for the investigation of individual and original ideas.
6. The organizational structure must be effective, but "redtape" must be reduced to a minimum.
7. There must be positive opportunities and incentives for interchange of ideas—between members of the same group, between different groups, and between different laboratories or organizations having similar interests.
8. The military needs must be expressed in terms of combat problems, not solely in terms of technical specifications.
9. The attitude of the military must be not that they are ordering a device from the factory, but that they are inviting the scientists to help solve a tactical or strategic problem.

It is evident that the military organization, as it now exists, does not begin to make it possible to have all of these positive conditions for successful research and development fulfilled. On the other hand, I believe that under a military organization all but one of these conditions could be fulfilled if the military agency were anxious to do so. The one which the military organization can not surely fulfill is No. 3, superb leadership. I do not mean that there are no military officers who can be superb laboratory directors. I do mean that even if a particular laboratory has a superb director for 2 or 3 years, he may then be transferred to some other duty and the continuity will be broken. As long as the position of director of a laboratory is regarded as a military post, subject to regular rotation, continuously good leadership cannot possibly be achieved. This point will be further brought out in my answer to question 4 below.

I turn now to your question 3:

"3. Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?"

If this question means to ask whether it would be desirable to establish within the Department of Defense a civilian organization reporting to the Secretary of Defense, which would be responsible for all military research and development programs, then my answer would be "no, such a plan would not be desirable." If the question refers to the desirability of a civilian organization within each of the

three military services reporting respectively to the Secretaries of the Army, Navy, and Air Force for the management of the research and development programs within the individual services, my answer would still be "no," though a somewhat less emphatic one. It is conceivable that such an organization would operate. It is not clear, however, that such an organization would assuredly create all the conditions necessary to success which I have previously set forth.

I think (though I am not positive on this point) that I would recommend that there be military agencies responsible for research and development programs, but that each individual laboratory carrying out such program shall itself be under a civilian director. This civilian director should really be the director and not merely a subordinate to a military post commander. He should be fully responsible for the operation of the laboratory and for the technical program within the general directives which are agreed on between him and the military research agency above him. The military needs would thus be presented through the top command, but the way in which technical developments shall meet these needs would be the responsibility of the civilian organization Specially trained liaison officers should be assigned to each laboratory and their job should be to assist the civilians in the development work and to provide logistic and other support to the laboratory program. Many of these officers should have combat experience which they should be instructed to share freely with the civilian scientists in order to increase the appreciation of the civilians of the military combat problems.

Your question 4 is as follows:

"4. Would it be feasible to organize military research and development programs in such a way that the technical activities capable of being performed by a civilian organization could be separated from those which are purely military, such as support functions? Where military support activities are necessary in connection with a research and development project, and such activities must be under a military commander, does it necessarily follow that the technical research and development functions must also be under direct military supervision?"

The answer to the first question here is "yes" and to the second question is "no." On these answers, I am quite firm in my opinion. I directed the Radiation Laboratory at the Massachusetts Institute of Technology during the war under the Office of Scientific Research and Development. Our laboratory, engaged in radar development, needed many military support functions, such as target airplanes for radar tests, airplanes into which to put trial installations for flight testing, facilities aboard naval ships for seaborne radar, etc., etc. In all cases, I, as civilian director of the laboratory, was able, through our military liaison channels, to secure the necessary support functions from the responsible military agencies. Indeed, an entire military airport and a considerable number of airplanes were placed at the disposal of our laboratory. The operation of the airport and of the airplanes was, of course, under military direction, but the military officers were under instructions to make these planes available to the laboratory as requested for research purposes within the limitations imposed by aircraft operation itself. There is no reason whatsoever why a laboratory which needs military facilities needs to be under military direction.

"5. To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs? To what extent should private, nonprofit institutions participate? To what extend should private industry participate? How much "in-house" research is required for the military services to be capable of exercising qualitative control over research and development conducted by outside laboratories?"

In my opinion, a very large fraction of the military research and development programs should be carried on under contract with civilian non-Government organizations. The Atomic Energy Commission has proved that this is an extremely effective method of operation.

Nevertheless, difficult questions arise when one determines which civilian organizations shall be chosen as contractors. When the job is for engineering and development for production of a device whose characteristics can already be easily visualized, such as a new truck or tank or a new model of aircraft, it is clear that a development contract with an industrial corporation with experience in the field is logical and desirable. This is the pattern which has been followed and should continue. My only suggestion here is that the industrial organizations be given a little more encouragement and latitude in themselves suggesting the ways in which the military requirements might be most effectively and efficiently met. At present they are often handed a set of technical specifications, whereas the engineers of the company could devise a better set of speci-

fications to meet the tactical problem if they were encouraged and given the information to do so.

Many military programs are now being carried on successfully by universities. I think this practice should not be further extended except in times of active emergency. Universities should carry on basic research programs, possibly with financial support of the military agencies. There will also be many special circumstances in which a particular university can carry on a military development program, even though the program is classified. However, the competent universities who can engage in these programs are now fairly well loaded with work and it does not appear that expansion of this practice would be feasible or desirable under present conditions.

There are, however, other types of nonprofit private institutions. There are, for example, a number of research institutes such as Mellon Institute, Stanford Research Institute, Midwest Research Institute, Battelle Memorial Institute, etc. These institutions were set up for the specific purpose of carrying out industrial and Government research projects and many of them have excellent supervision and staffs. More use could be made by the Government in assigning the management of important research laboratories to such organizations.

There are also special nonprofit corporations which have been set up, such as the Rand Corp. and Associated Universities, Inc. If the Government could find a way of providing the initial financial help required to start such corporations, it is quite possible that this mechanism would be a very useful one in the future. It should certainly be given careful investigation.

I am afraid I have given a rather long reply to your series of questions. However, as I indicated at the beginning, your questions cannot be given flat "yes" or "no" answers. I think possibly my only really important suggestion is that your committee examine ways in which the military services can create the positive conditions necessary for outstandingly successful research work and to study seriously how these conditions can be created. It is my opinion that they can be created under present military organizational policies, provided the delegation of responsibility to civilian agencies or a civilian director can be arranged. However, if any of the positive conditions for successful research which I have enumerated cannot be accommodated under present military policies, then such policies should be altered or other arrangements made. The future security of this country depends vitally upon having not just a mediocre, but an outstandingly successful military research and development program. No effort and no alteration of military policies is too great a price to pay for success.

I am sure there must be many parts of my comments which are not clear to you and I would be glad to try to clarify or answer any questions which may occur to you.

Very truly yours,

L. A. DuBridge.

P. S.—The above letter represents my personal views and in it I am not speaking for any organization or committee, private or Government.

L. A. D.

Bell Telephone Laboratories, Inc.,
Murray Hill Laboratory,
Murray Hill, N. J., June 3, 1954.

Hon. R. Walter Riehlman,
Chairman, Military Operations Subcommittee,
Committee on Government Operations, Washington, D. C.

Dear Mr. Riehlman: I have your letter concerning the inquiry of your Military Operations Subcommittee into the operations of various scientific research and development programs in the Department of Defense. The operation of Government-supported laboratories has been a matter of considerable interest to me over the past several years. I should therefore be happy to discuss some of the broad questions involved with a member of your staff. I have no plans to be in Washington in the near future but should you consider such a conversation to be appropriate, either our laboratory at Murray Hill or our laboratory in New York City might serve as a convenient place to meet.

The types of questions which you raise in your letter as representative are indeed important ones. Each one in turn could be the subject of a fairly extensive essay. Hence, I would think it somewhat inappropriate to attempt short answers or comments in the course of this letter.

However, there is a broader question not raised explicitly in your letter which may deserve mention here. This has to do with the technical "mission" or charter which is given to a laboratory. I am persuaded that the primary and necessary condition for the success of a laboratory of the sort we are here discussing is a comprehensible and important task. This, together with leadership in the laboratory and in the management above the laboratory, is a condition which must be fulfilled before many of the subsidiary questions have significance. For example, there are many Government-supported laboratories well equipped with able enough people, but whose charter or mission is ill defined or lacks focus, or whose direction comes from some remote agency whose understanding of a military requirement may not be matched with equal comprehension of the technical possibilities for meeting the requirement.

The lesson of Los Alamos I believe is a very good one: If one recalls the real doubts in 1946 that the Los Alamos Laboratory could even survive, then its strength, vigor, and superb accomplishments of the past few years must be acknowledged as outstanding phenomena. There were many severe handicaps to the postwar growth and present eminence of Los Alamos. But they had a job to do—important and comprehensible—and, faced with this challenge, they responded beyond expectation and developed the leadership to do their job.

By contrast, few other Government-supported laboratories have charters with adequate focus and corresponding technical responsibility. It is true, of course, that other characteristics of the Los Alamos Laboratory have contributed to its uniqueness. But there are examples of highly successful research and development laboratories, with far less dramatic charters than Los Alamos, whose success I believe has been due fundamentally—but not solely—to a clarity of important purpose.

Many subsidiary questions to which a laboratory director—and his higher management—must address himself to accomplish his mission I recognize. I should be glad to discuss them with your staff should you so desire.

Yours sincerely,

J. B. FISK.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
OFFICE OF THE DEAN OF SCIENCE,
June 17, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
House of Representatives, Congress of the United States,
Washington, D. C.

DEAR MR. RIEHLMAN: This is in reply to your letter of May 26. I do have some definite ideas about the operation of scientific research and development programs in the Department of Defense, and would be glad to talk with a representative of your subcommittee, if this is desired. Also, if you or he felt that it would be desirable, I would be glad to appear personally before the subcommittee, although I would hope that this might prove unnecessary.

My views in regard to research and development for the armed services were formed as a result of my experiences as Chief of the Optics Division of the National Defense Research Committee from 1940 to 1946, and from acting as Assistant Chief of the Office of Field Service of the OSRD in 1944, during which time I served for a period at General MacArthur's headquarters setting up a research division for the Southwest Pacific area. I have also spent much time since the war in directing investigations under a number of Government research contracts.

First, answering the questions which you ask specifically, I would say

1. I believe there are characteristics inherent in military organizations which are incompatible with the administration of a long-term effective program of scientific research and development. Military organizations have shown themselves very effective in continuing long-term programs of development which have resulted from a strong civilian impetus, but in general there is likely to be a decline in imaginative resourcefulness once the military organization takes over.

2. I believe the answer to your second question is "Yes," also. In general, a smaller fraction of the scientists engaged under military supervision in developing weapons in peacetime is of higher quality than that which can be thrown into such developments during an emergency.

3. I do not believe that it would be desirable to establish a civilian organization to administer military research and development programs except in an advisory

capacity, and also except in time of emergency. During World War II there was very close cooperation between civilian and military agencies as a result of the fact that each was made more or less independent of the other. If the military had been in control of all research establishments at the beginning of World War II, a large proportion of the new weapons developed would not have been introduced. In my opinion, the Office of Scientific Research and Development was outstandingly successful in breaking down the military barriers to the development of new weapons. Military minds are influenced by the military organization in the direction of being conservative in scientific matters. This works very well in the development of a new weapon after it has been invented and produced, but must be supplemented by the type of imagination which is usually found most among scientists, especially those who are nonconformists.

4. I believe that it would be feasible to organize military research along the lines outlined under four in your letter. The technical research and development functions need not at all be under direct military supervision so long as there is proper understanding and cooperation between the civilian and military agencies. This has worked out very staisfactorily in a number of cases during World War II.

5. I believe the Department of Defense should contract with nongovernmental institutions to carry on military research programs, but to a less degree in regard to development programs. Private and nonprofit institutions should participate to the extent of their ability and willingness. Private industry should participate also. The Office of Naval Research has done an outstanding job, thus far much more successful than that of the purely civilian National Science Foundation, in the support of fundamental research throughout the United States as well as of research which can be expected to lead directly to military development. One of the most important aspects of this program is the development of increased numbers of scientists and the opening up of new fields of investigation, both of which categories are likely to be badly needed in time of emergency. A military mind is likely to plan to fight next year's war with the last war's weapons improved along fairly conservative lines. What is needed is the development, to be on hand for emergency, of a large corps of imaginative scientists who can then be thrown into the breach at the beginning of an emergency to make use of the latest scientific developments for the production of new kinds of weapons.

I believe that a certain amount of research should go on in all scientific laboratories of defense organizations, because only by this means can they keep their personnel up to date and attract a live corps of imaginative scientific personnel. I believe that the system we are now developing is a very good one, namely, the one in which a certain amount of weapons developments is going on in military establishments, a certain amount is being carried out in industry and in public and private educational institutions, and a fairly large amount of fundamentl research is being supported through Government contracts. Much more needs to be done in the attracting of able young men, particularly those of imagination, who tend to make the greatest inventive and scientific contributions.

Sincerely yours,

GEORGE R. HARRISON,
Dean of the School of Science.

NEW YORK UNIVERSITY,
COLLEGE OF ENGINEERING,
New York, N. Y., June 2, 1954.

Mr. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
House of Representatives, Washington, D. C.

MY DEAR MR. RIEHLMAN: I have your letter of May 27 concerning the operation of various scientific research and development programs in the Department of Defense.

Before commenting on the questions raised in your letter I wish to point out that my contact with research and development of the Defense Department is partly due to the fact that the Department of Meteorology and Oceanography of New York University has research contracts in meteorology and oceanography with various military agencies, and partly due to my former membership on committees and panels of the now dissolved Research and Development Board.

From my own contacts with various agencies of the Defense Department (specifically the Geophysical Research Directorate of the Air Force Cambridge

Research Center, the Office of Naval Research, and the Beach Erosion Board of the Army Corps of Engineers) I would judge that the cooperation between the sponsoring military agencies and the nongovernmental (in our case "private nonprofit") organizations is in general very satisfactory and fruitful. Credit for this successful cooperation appears to be largely due to the officers, civilian and military, of these agencies of the Defense Department. Most of these men are, or have been, active in scientific research and development and understand the problems arising in this kind of work. I believe that for a continued fruitful cooperation between private organizations and the Military Establishment it is at least as important to retain such personnel in the research and development agencies as to evolve regulations insuring a smooth cooperation between the groups concerned. There are, of course, certain difficulties which arise from time to time, but these are, I believe, due not to the fact that we are dealing with a military organization, but to the necessarily complex organizational structure of the Government as such.

I believe that it is important for the Defense Department to continue its policy of contracting with nongovernmental institutions to carry on military research and development programs. There are, of course, many outstanding scientists associated with Government agencies. But because of the much greater number of private organizations, such as universities, colleges, nonprofit research organizations, such as universities, colleges, nonprofit research organizations, the great majority of scientists, and in particular of specialists best qualified to handle one or the other special problem arising out of defense requirements, will be in general found among nongovernmental organizations. Therefore, the cooperation of such private establishments will as heretofore be required if the most competent men are to handle the specific problems of research and development which need to be solved. It is impossible for me to say how much of the research should be performed "in house" by military organizations, and how much should be performed by outside contractors, such as private industry and private nonprofit organizations. I doubt very much that an overall figure for such a division can be established. In many cases the division will depend on the available manpower inside the military agency and outside. As you know, this manpower is by no means unlimited, especially if it comes to personnel qualified to conduct and direct research independently.

I believe that the present system of "project scientists" used by the Geophysical Research Directorate of the Air Force Cambridge Research Center insures very well the control of the military agency over research conducted outside. Under this system a scientist in the military agency is assigned supervision of the scientific work conducted by the private organization and keeps himself, by visits and by regular reports sent to him, familiar with the progress of the contract work. He is thus in a position to change the direction of the work if that appears necessary in the interest of the Defense Department.

I realize that the foregoing remarks leave unanswered a great number of questions raised in your letter. I have merely commented on some of the problems with which I felt especially familiar. In conclusion I would merely wish to add that the problem of Government-sponsored research at universities is closely related to that of the training and maintenance of an adequate pool of scientific and technical manpower because many students are able to pursue a graduate course of studies these days only because they can work part time on Government-sponsored research projects. Eventually, the National Science Foundation, when it has more money available, will presumably play an ever-increasing role in this connection. In the meantime, however, I believe it is important to keep in mind that many of the funds expended by the Defense Department in contractual work at universities contribute not only to the advancement of knowledge and technology, but also to the augmentation of the scientific manpower potential of the Nation which is of vital importance to our national security.

I regret very much that I shall not come to Washington in the near future. I am leaving in 3 weeks for New Mexico where I shall spend the rest of the summer. If you believe that I can be of further service to you I should be glad to meet with one of your staff members here in New York before this time.

Sincerely yours,

B. HAURWITZ,
Chairman, Department of Meteorology and Oceanography.

UNITED STATES NAVAL ORDNANCE LABORATORY,
White Oak, Silver Spring, Md., July 12, 1954

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Committee on Government Operations,
House of Representatives, Washington, D. C.

DEAR MR. RIEHLMAN: I was delighted to receive your letter of the 8th of July and to get the opportunity to present some of my ideas on the problems confronting our military research and development program. As you know, in the past 10 years I have been associated with Los Alamos Scientific Laboratory, Sandia Corp., Naval Ordnance Test Station, Inyokern and the Livermore Laboratory of the University of California. Prior to this time I had experience as Chief of the Instrument Development Section at the Naval Aircraft Factory which subsequently has moved to Johnsville, Pa. This has permitted me to get a cross-section of the various methods of operation.

The following are the problems that confront this type of program:

1. That of attracting and retaining an appropriate share of people of outstanding ability. This must be done in the face of keen industrial competition for the same people, and what the military laboratories must do is largely determined by the practice of the industrial laboratories.

2. Problems in attracting able technical people:

(*a*) Entering pay is about $100 a month below that offered by industry. The military laboratories get too few graduates and they are of inadequate quality.

(*b*) Opportunity for advanced training is an important attraction. Many military laboratories cannot offer this under present rules. Those who do are now being outdone by industry, which not only provides time but pays the tuition and expenses.

(*c*) Ceiling pay in the laboratories is about half that of industry for senior positions. The far-sighted bear this mind when choosing between industry and Government, and the more venturesone (an asset in research and development) too often choose industry.

3. Problems in retaining able technical people:

(*a*) Leave in Government is no longer the inducement it was. It is hardly competitive with industry and should be liberalized for professional people.

(*b*) Participation in professional societies is too difficult. Travel to their meetings should be liberalized and administration localized. Industry goes further and pays the dues in some cases.

(*c*) Per diem allowance puts the Government worker under too severe a handicap (in comparison with industry).

(*d*) The dignity of the individual sometimes suffers unnecessarily by the imposition of excessively detailed rules; unwise differentiation between the military and other professions; or failure to recognize the professional status of scientists and engineers.

(*e*) Fluctuations in program level, which cause reductions in force or violent expansions destroy the stability necessary for the long-term programs involved.

(*f*) Retirement provisions in Government are good, but industry is catching up so fast that they no longer offer much differential inducement.

The various types of operations of the laboratories I have been associated with bring out the above problems very clearly. As an example, Los Alamos Scientific Laboratory was run for the Atomic Energy Commission by its contractor, the University of California. It has met a lot of the above problems, and has solved a considerable number of them. This contractor being a university, however, immediately became competitive with the Sandia Corp. Laboratory which was run by the contractor, Western Electric, which typified industry. It quickly became apparent that the university pay scales were not in line with industrial practice. Comparison of contractor-operated laboratories with the Government-run laboratories such as Inyokern or the Naval Ordnance Laboratory emphasizes the differences between these types of operation.

It is my belief that the effort as now organized at the Naval Ordnance Laboratory can be the most successful type in the solution of the problems in the technical fields that face the military. The diversity of the Laboratory's interests creates a demand for people trained in many fields. The requirements of the user make it most important that they be welded into an effective team with the military. This does not mean that the philosophy of responsibility that now prevails in the relationship of a commanding officer to his ship can be projected into the Laboratory. The success of obtaining the finest weapons in the world for our Armed Forces is greatly dependent on this team effort between the military and competent

scientific and technical personnel. This emphasizes that research and development is a joint professional activity that requires the best creative ability of both groups in place of one-sided emphasis. Where the Laboratory is completely removed from the military influence, one sooner or later gets into great difficulty on meeting operational requirements. The history of the Weapons Division at Los Alamos and its evolution into the Sandia Corp. is one that highlights this problem.

Research and development activity is inherently expensive. It is my belief that the military departments get more for their dollar with the present type of operation than if they shifted to the contractor plan as at Sandia or Los Alamos. However, it must be admitted that this type of operation is one way around the multitudinous rules and regulations that govern direct Government operation.

In closing, I want to emphasize once again that I feel that the obtaining and keeping of competent scientific leaders and technical people are the biggest problems that face us. The results and progress of our programs will be in direct proportion to our success in accomplishing this. If I can help you any further, please feel free to call on me. I would be delighted to discuss it at your convenience.

Sincerely yours,

JOHN T. HAYWARD,
Captain, United States Navy, Commander.

THE RICE INSTITUTE,
Houston, Tex., June 7, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman of the Military Operations Subcommittee,
Committee on Government Operations,
Washington, D. C.

DEAR MR. RIEHLMAN: In reply to your letter of May 26, I am glad to try to give my first reaction to the questions included in your letter. I do this, however, with a certain hesitation because I know how easy it is to be critical, and how difficult it is to suggest any reasonable correction of difficulties which some times loom so large. Nevertheless I make the following comments as representing my feelings at the present time, and based on my limited observations.

1. I believe there are characteristics inherent in military organizations which are somewhat incompatible with the administration of an effective program of scientific research and development. Among these may be mentioned:

(*a*) The necessarily authoritarian organization of a military establishment. A good member of a military organization accepts his superior's judgment, his views and his direction without question. Nothing could be more destructive of real progress in research and development. I have on occasion made the comment that if, in a research organization, there is a difference in opinion about a technical problem between a junior member and the director, the junior member is very probably right. A military organization finds such a situation difficult to deal with.

(*b*) A military organization requires a certain interchangeability of personnel. A man with a certain rank or rating is expected to be able to handle all of the responsibilities given to such a rank and to be able to move from one organization to another without serious loss of time. Research, on the other hand, is a very personal matter. It takes a man a rather long time to work himself into the spirit of a given research problem, and he must be permitted to stay with it long enough to carry it through.

2. I believe it is true that the military organization of a research and development program does tend to create conditions which retard the work of scientists and make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel. Part of this is associated with the necessary secrecy surrounding such work. Secrecy and scientific progress are almost contradictory terms.

Another part is due to the situations mentioned above under 1. The organization of some Government laboratories, in which there is a civilian director and also a military director, is a good step forward in meeting this problem. It is especially effective when both directors have a broad enough understanding of the situation to see the limits of their respective spheres of activity. It is still inadequate, however, if the military director feels himself responsible for the scientific output of the laboratory, or for maintaining a military atmosphere.

3. It would seem to me quite proper to establish a civilian organization to administer military research and development programs. The military services would then serve somewhat as the customers of the laboratories, and it would be the military services which would determine whether the output of the laboratories was useful or not. Of course it is also important that the laboratory have a full understanding of military needs. This can perhaps be obtained in part by permitting the civilian members of the laboratory to make close observations of military operations, techniques, and needs, as well as by the rotating assignment of military liaison officers.

4. It would seem to me the procurement for the military services should be divorced from research and development. A research laboratory is not in any sense a manufacturing organization. The military organization must determine what supplies it needs and in what quantities. The research organization can supply only ideas and suggestions for consideration by the user.

5. I have no very clear opinion on the extent to which military research and development should be done by Government laboratories or by outside laboratories under contract. There needs to be a close connection between the development engineering group and the manufacturer. There also needs to be a close connection between the research organization and the development engineering. This close cooperation between all three phases is of the utmost importance, but does not necessarily involve unified management or military management. The military organization has the ultimate responsibility for deciding whether the research development is worth while.

It is certainly necessary for the military procurement agencies to have adequate means for testing equipment supplied by manufacturers. Such testing, however, should not be confused with research, and perhaps needs only to be such as to assure conformity with the specifications.

It is also important that the Military Establishment have adequate means for full-scale-testing of weapons and weapons systems, and such testing needs to be in close cooperation with the research and development activities.

As I said in the beginning, the above comments are rather "off the cuff." They are certainly influenced by my special interest in research and development, and for that reason, probably do not give a fair picture.

I shall be glad to consult with you, any members of your committee, or any members of your staff if it would be helpful. I am not planning to be in Washington in the immediate future although I do expect to be in Newport June 25 and 26. I shall then be free to be in New York or Washington until July 1 or July 2 when I am leaving for England for a couple of months. If it would be of any value, I would be glad to meet with a member of your staff in New York, or possibly Washington, sometime between June 26 and July 1.

Very truly yours,

W. V. HOUSTON, *President.*

DEPARTMENT OF THE NAVY,
OFFICE OF INDUSTRIAL RELATIONS,
Washington, D. C., July 16, 1954.

Hon. R. WALTER RIEHLMAN,
House of Representatives, Washington, D. C.

DEAR MR. RIEHLMAN: In view of your interest in personnel engaged in research and development, I am forwarding to you a copy of the April 1954 issue of Industrial Science and Engineering which contains an article (p. 6) entitled "Basic Research Projects Show Diversity of Career-Job Areas in Civil Service."

The article points out to graduating engineers and scientists that, while Federal employment does not always match industry's beginning salaries, there are compensations for whatever period it takes to catch up salarywise with industrial contemporaries. The writers consider the opportunity for professional and personal development as one of the chief advantages of employment at a Government laboratory. In support of this point of view, they show how employees are developed by means of training through the utilization of a diversity of functions and equipment. As these employees achieve greater depth through this diversity of work and experience, they are promoted and also gain early recognition. The additional advantages of better leave and retirement benefits are also presented in the article.

Sincerely yours,

GEO. A. HOLDERNESS, JR.,
Rear Admiral, USN, Chief of Industrial Relations.

PURDUE UNIVERSITY,
Lafayette, Ind., June 15, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Committee on Government Operations,
The House of Representatives, Washington, D. C.

MY DEAR CONGRESSMAN RIEHLMAN: In the press of commencement and the termination of the school year, I was unable to give adequate attention to your letter of May 27 describing the inquiry of the Military Operations Subcommittee into the administration of scientific research and development programs of the Department of Defense.

The five representative questions your subcommittee has posed go to the heart of the problem and I fear no individual can give adequate and definitive answers to such questions—at least my own experience is not broad enough to attempt answers in writing.

Also, with respect to this problem, my own position is complicated by the fact that just 3 weeks ago I accepted membership on the Subcommittee on Research of the Commission on Organization of the Executive Branch of the Government, headed by former President Hoover. The Subcommittee on Research, of which I am now a member, is headed by Dr. Mervin J. Kelly, of the Bell Telephone Laboratories. The staff of this subcommittee is currently gathering pertinent data and we are scheduled to report to President Hoover's Commission sometime this fall. In view of this commitment to investigate and report on the same subject which your subcommittee is looking into, I think I should not testify or put my views in writing at this time.

I have a 1-day meeting in Washington on Friday, June 25, at the American Council on Education. I could arrange to see 1 of your staff members for a short conference that afternoon, say between 4 and 5 o'clock, or I could arrange to stay over for a conference Saturday morning.

Will you have the appropriate staff member write to me indicating his pleasure with respect to a meeting on the afternoon of June 25 or the morning of the 26th?

Yours cordially,

FREDERICK L. HOVDE, *President.*

UNITED STATES DEPARTMENT OF COMMERCE,
NATIONAL BUREAU OF STANDARDS,
Washington 25, D. C., July 19, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations,
Subcommittee of the Committee on Government Operations,
House of Representatives, Washington, D. C.

DEAR CONGRESSMAN RIEHLMAN: I was most pleased to receive your letter of July 8 requesting a short statement from me giving my views on "the most important problems confronting our military research and development program today." From the context of your letter it appears that you seek information about the operation and administration of the program rather than a statement of the particular technical and scientific problems most in need of solution. Consequently my statement, which is attached, treats of the problems of administration and operation.

In accordance with your instructions, it has been made brief and general. If you or your committee should feel that more information is desirable I will be pleased to have an opportunity to write further or to appear in person to give explanation.

I feel very deeply the important responsibility given me in this opportunity to express my views before your committee. The question you pose is of such importance for national survival that I approach it with great humility and the hope that I can in some small measure contribute to the efforts of your committee to arrive at an optimum answer.

Please accept my sincere appreciation of this opportunity to contribute.

Sincerely yours,

R. D. HUNTOON,
Associate Director for Physics.

STATEMENT FOR MILITARY OPERATIONS SUBCOMMITTEE OF THE COMMITTEE ON GOVERNMENT OPERATIONS BY R. D. HUNTOON, ASSOCIATE DIRECTOR FOR PHYSICS, NATIONAL BUREAU OF STANDARDS

In reply to the question: "What do you consider to be the most important problems confronting our military research and development program today?"

IMPORTANT PROBLEMS CONFRONTING OUR MILITARY RESEARCH AND DEVELOPMENT PROGRAM

I. INTRODUCTION

The statement which follows is primarily concerned with the operation and administration of military scientific research and development and in delineating the important problems which need prompt attention and careful consideration.

The working premise on which the discussion is based is this: in the present situation in the world as we know it, this Nation and Government must rely upon great technical superiority over its enemies in order to survive. We must overcome a deficiency in numbers by applying our economic resources and ingenuity to the construction of weapons which will in effect multiply our numbers and thereby provide the defense we need.

Any program of action we devise, whose object is to maintain and enhance our technical superiority, must in one form or another provide these essentials:

1. Technical manpower

A body of trained scientists and engineers to produce the ideas and develop them into practical workable devices.

2. Research and development facilities

Laboratories and facilities with which the talents provided by (1) can be exploited to the utmost.

3. Operation and administration

A set of operating policies and administrative procedures which permits the trained staff (1) to work harmoniously and effectively with the facilities (2) to form a dynamic, creative, progressive, productive activity.

4. Problem selection

A means whereby this activity is so coupled to the military departments that it has full awareness of nature and relative importance of problems in need of solution.

5. Evaluation

A means whereby the ideas and developments which emerge are realistically evaluated for effectiveness and a balanced program of production of the most effective weapons established.

6. Training

A means for training the military combat units in the proper use and exploitation of the new weapons.

7. Production

A source of material and a production facility capable of producing the required amounts of each weapon.

8. Dispersal

A plan for such dispersal of this activity as is required to prevent its loss or immobilization by an intense but relatively localized attack.

It is clear, of course, that the emphasis given each of the eight essentials listed above must be weighed and balanced against the other needs of the Nation and its economy. This is the proper function of the elected leaders of our country and I am neither qualified nor presumptive enough to treat it in this statement. In what follows a few general comments on each of the eight essentials will be presented from the point of view of a scientist in a civilian Government laboratory who has had some 8 years of experience in working with the Department of Defense on the creation, development, evaluation, and exploitation of new weapons.

II. CREATIVE AND PRODUCTIVE RESEARCH AND DEVELOPMENT ACTIVITY

Items (1, 2, 3) technical manpower, facilities, and administration provide the basis for the creative activity upon which our technical superiority rests. Unless this is well in hand the remainder is futile. I feel that the situation here is far from optimum, that there are real and serious problems which require careful attention.

1. Technical manpower

It requires years of training and experience of a continuing nature without major interruptions or diversions to produce a capable scientist or engineer. The individual is also required to make considerable personal investment of funds, to delay establishment of normal family life, and to live in reduced circumstances in order to acquire the training.

Leading administration officials, educators and heads of laboratories have commented recently in the press on the widening gap between supply and demand for scientists and engineers. They point, rightly, with alarm at how our enemies are stimulating and building their pool of trained technical men and how our own program is falling behind in comparison.

Our great technical achievements in the last war have led us to a smug complacency which must be shattered for it carries the seeds of our downfall. I think steps to shatter it are encouraging and desirable but this is not enough.

At present our military deferment policies are such that there is frequently not adequate incentive to make a young man seek and sacrifice for the needed technical training. He can look forward to a chance to complete his training if his skills are great enough, but then he must contemplate a prolonged interruption in the form of military service just at the time of his greatest creative period (20–30 years). He must then try to recover lost ground and contemplate further sacrifice to get established. Under the circumstances, I feel it is not surprising that in many cases he turns to other forms of endeavor where the rewards are more prompt and the sacrifice less severe. I feel that this country should recognize scientific service in the defense effort to be fully the equivalent of military service and take the necessary steps to implement the realization.

We are falling behind and we are in serious need of more technical manpower.

2. Research and development facilities

While the research and development facilities languished severely prior to World War II, the great buildup during the war and the large support of research and development activities since the war has provided us with fine well-equipped laboratories. There has been an alarming trend to curtail the long range fundamental activities, in the last year and a half, in favor of the short-term-immediate-results kind of activity. I feel that this trend should be stopped but also I feel that there are more serious problems than the one of providing more laboratories and more equipment than has been forthcoming in the years since the war ended.

3. Operation and administration

It is in this sphere that most serious and disturbing problems are present. It is of little value to have the trained manpower and well equipped laboratories if the operating policies are such that a proper proportion of the most able scientists and engineers cannot be attracted to work in them, and to work with optimum efficiency.

Four main patterns of operation have emerged: (*a*) Government-defense, (*b*) Government-civilian, (*c*) University and (*d*) private. Each has its place. Dr. L. A. DuBridge has presented an analysis of the effectiveness of each type.[1]

There are those who feel that the Government should withdraw and let the universities and private concerns operate the laboratories. I feel this is a great mistake. There is a place for each and I feel that there are certain phases of weapon research which require a philosophy different from that in the commercial or university laboratories.

The Department of Defense should have and should operate large research and development laboratories. But I feel strongly that such laboratories should not be operated like any other military installation. The management should be stable, not rotated, and should have able technical men in control and authority. It is tempting to say that the laboratories should be completely under civilian control. This arises from the fact that it takes years of technical training to produce an able technical leader, which, except in some cases, is not consistent with the additional training required of an able military leader.

[1] Science and Government, L. A. DuBridge, Chemical Engineering News, April 6, 1953, pp. 7, 14, 15, 16, and 19.

If military officers are to direct the laboratories they should either be selected for technical competence on a competitive basis with civilians and allowed to stay for a long period with one institution, or required to delegate the authority for operation to a civilian of proper competence. This delegation needs to be so complete that the position of the nontechnical military officer in charge becomes almost that of figurehead. These requirements for technical training and proficiency, and permanence of assignment probably mean that the technical military officers would not be looked upon as military officers in the accepted sense.

In any case it is clear that technical people work best for a stable management consisting of able scientists whom they respect for their technical accomplishments and for their understanding of the philosophy of research and development. If this is provided the exact mechanism is secondary. It does not now, in general, exist in the Government defense laboratories and has been recognized as a serious problem by scientists for many years. My discussions with the technical leaders of important defense laboratories, some of whom have recently resigned, indicates that the changing policies of the rotating commanders and the need to educate each about the difference between a research laboratory and a typical military command is viewed as a very serious problem. It hampers their effectiveness and reduces the productivity of the whole organization.

One cannot leave the problem of the proper atmosphere of operation and administration without a word about security. The fact that a large proportion of the work is by nature classified requires further sacrifice by the scientists. Their reputation and job satisfaction comes primarily from their technical achievements and the regard of others in the scientific society and only secondarily from monetary rewards.

In my opinion almost the entire scientific body agrees to the need for the protection of the essential secrets and for care in the selection of loyal, secure personnel to work in the laboratories, and they are willing to make the sacrifice for the good of the country provided:

(*a*) Reasonable and understandable security restrictions on information are imposed with provision for freedom to publish the fundamental discoveries while keeping secret only the essential secrets.

(*b*) The investigations of personnel are handled on an impersonal basis, carefully and discretely without hysteria. They rightly expect that the disloyal or risky should be eliminated from such work but feel strongly that this should be done in accordance with our system of "fair play." Actions should be based on sound evidence carefully evaluated. Indiscriminate smear by publicity should be prevented and the few unsuitables, who must be eliminated, should be eliminated quietly without bringing dishonor and disgrace to the innocent. Recent events have, I feel, led some loyal devoted scientists to fear that they cannot risk their careers and reputations by working in the Government service because of the possibility of some irresponsible security investigation or procedure.

The rules should be definite, clear, and stable and should be discretely but firmly applied alike to all.

III. COORDINATION WITH MILITARY OPERATIONS

Items (4, 5, 6,) problem selection, evaluation, and training are all concerned with the proper coordination between the research and development activity and those who devise the strategy, fight the war, and use the weapons. Unless the right weapons are developed and produced the research and development activity has been worse than useless since it has drained off effort that could be fruitfully used elsewhere.

4. Problem selection

It is essential that the scientists and engineers become fully appraised of the problems which require solution. It is not sufficient that the military officers decide what is needed and tell the scientists what they want. The scientists and the military users must work hand in hand as a team to attack the problems. Many of the problems require extensive technical knowledge as well as knowledge of military tactics and strategy before an appropriate solution can be roughed out. The military officer all too frequently is not adequately aware of the state of the art technically to be able to understand what is practically realizable and the scientist is not adequately aware of the tactical needs and military requirements to devote his efforts to the problems most urgently in need of solution.

Important attempts have been made to solve this problem. The Office of Scientific Research and Development (OSRD) was a good start during the war but its successor the Research and Development Board was so constituted that the

civilians could contribute effectively only under great difficulty and as a result the more able scientists preferred to devote their energies elsewhere where they could be more effective. The recent establishment of an Assistant Secretary for Research and Development has great possibilities if handled properly. At the present it is my feeling that this problem of getting the necessary joint effort on the selection and delineation of the technical problems to be solved is still serious and requires much careful attention by some of our most able leaders.

5. Evaluation

Once the weapons have reached the prototype stage it is essential that a determination be made to see that they do the job for which they were designed, and that they do it better or more cheaply than existing weapons whose development costs have already been expended. Here again closely coordinated joint effort is required.

In my experience during the past war I saw valuable weapons delayed in their use or prevented from use because of improper evaluation.

The military proving grounds frequently put combat officers without technical training in charge of the evaluation of new weapons which they did not understand. Scientific counsel was not admitted or called upon until too late. In instances the weapons were evaluated in a situation for which they were not designed, or intended, with consequent failure. This failure was generalized to other situations and the weapon was banned only to be revived after much pressure to get reevaluation under the joint control of military and scientist working together. The lost time and economic waste in these mistakes were great. The situation may have improved in the years since the war. My brief contacts do not indicate that it has improved markedly and I feel that a careful study should be made to see that proper evaluation with military officers and scientists collaborating closely is provided. This will insure that only the best weapons are put into sizable production. Mass production is of course much more costly than research in money and critical materials and should be undertaken only when proper evaluation shows it to be desirable.

6. Training

Adequate training aided by a mechanism which provides a feedback to the research and development activity for faults developed in use, or for innovations discovered by intelligent users, provides a double value. It provides proper use of the new weapon by giving a knowledge of its potentialities and prevents its misuse, or lack of use through ignorance. It also provides a proving ground for discovery of faults and for the incorporation of improvements seen by the ingenious user.

My experience with the training aspect has been limited but it has indicated one important deficiency worthy of study. Those weapons which develop outsite the normal chain within the Department of Defense, as happened with some important developments under civilian controlled OSRD, find that adequate training of military personnel has not anticipated introduction of the weapon into combat. This is a costly oversight and can be disastrous. The situation should be examined to see if present planning integrates the training of personnel with the introduction of new weapons produced under contract with civilian agencies.

IV. DISPERSAL AND PRODUCTION

It is futile to devote energy and funds to the achievement of a superior productive research and development program unless there stands ready behind it production capacity to turn out the weapons, and unless it is so protected from attack as to continue to function during a war.

7. Production

The research and development program must be geared to the productive capacity of our economy in a realistic manner. To devote expensive manpower and facilities to the development of a whole spectrum of weapons whose production in adequate numbers exceeds our productive capacity is a serious error. How to avoid making such an error is a problem worthy of important attention but is beyond the scope of this statement and will not be treated further.

8. Dispersal

It does, however, seem appropriate to include the problem of dispersal among the important problems of the operation of the research and development activity. It may well turn out to be one of the most crucial problems of all and the most difficult to solve.

Many of our important laboratories are located in primary industrial target areas and in the event of attack would wiped out. In the event of a short war the outcome would depend on past accomplishments and the loss would not be felt immediately. In a long war, the loss would be disastrous. This is a problem in strategy and planning which needs careful evaluation now.

The problems of moving going laboratories to more remote areas are serious. The relative isolation of the staffs from the information produced in other laboratories will lead to loss of productivity and will tend to keep the able scientists from working in the more isolated laboratories. The cost of the move is almost astronomical and in addition much greater freedom for travel between the laboratories will need to be provided. In this connection it should be pointed out that the present restrictions on travel to scientific meetings now in force in the Department of Defense are in my opinion a serious handicap. They are preventing the scientists from free access to the very lifeblood of their productivity and are further isolating the Department of Defense laboratories from the scientific community at large. This prevents the free interchange of ideas in the formative stage which so often results in the appearance of brilliant innovations.

Finally it should be pointed out that dispersal of the research and development laboratories is closely linked with the dispersal of the production facilities and that both must be considered together in any comprehensive plan for dispersal.

V. CONCLUSION

In conclusion I wish to emphasize that the opinions expressed in this statement are strictly my own. I have tried to give such careful consideration to this vital question posed to me as time would allow and still permit the statement to reach the subcommittee in time to be useful. The statement should be considered as a group of opinions based on my own experiences and not the result of any concentrated or lengthy study of the situation.

I would consider it a privilege to elucidate further should the opportunity arise.

UNIVERSITY OF CALIFORNIA,
DEPARTMENT OF PHYSICS,
Los Angeles 24, Calif., July 17, 1954.

Hon. R. WALTER RIEHLMAN,
House Office Building, Washington, D. C.

DEAR MR. RIEHLMAN: Thank you very much for your kind letter of June 28. I would have acknowledged this sooner, but I've been in Washington most of the past month in connection with the geophysical year program. Incidentally, we have had very good hearings before the House and Senate Appropriations Committees, and it is my understanding that the governmental support for the program has been endorsed by the House committee, and will come up for action next week as part of the President's request for supplemental funds. I am enclosing two brief items relative to the program.

It was a real pleasure for me to have had the opportunity to help you, and I enjoyed my session with Mr. Balwan. The business of getting the most out of defense research and development budgets is a complex one, and much remains to be done. I think that your interest in this and your willingness to get into such a difficult area is a fine development.

Please send me a copy of the printed hearings and of the report when available. I expect to be connected with the program for a long time and you can always count on my help.

Sincerely yours,

J. KAPLAN.

THE INTERNATIONAL GEOPHYSICAL YEAR

The international geophysical year designates a program of cooperative research by more than 30 nations in some 10 fields of geophysics. This international effort will occur during 1957–58, when intensive observations and measurements will be made simultaneously throughout the world. Studies at existing stations and observatories will be intensified; new stations will be established at critical sites, ranging from the north polar regions to the Antarctic. Every major land and sea mass will be covered in this study, and the measurements will extend

from oceanic depths to a hundred and more miles above the surface of the earth where rockets will carry instruments to determine directly the nature of the upper atmosphere.

The period of actual observations, as well as the stations which will be used, have been selected with the object of having a minimum program with maximum results. Since the sun is the key to many geophysical problems, especially those related to weather and telecommunications, the time set was based on the increased probability of occurrence of solar flares and other disturbances during 1957–58, a period of sunspot maximum.

The need for an international program in geophysics stems largely from the global nature of the phenomena. The weather in one place, for example, has had its origin many thousands of miles away in a set of complex events related to solar activity, to oceanography, and to hydrology. Any marked advance in weather forecasting requires worldwide meteorological data of both the lower and upper atmosphere in both the Northern and Southern Hemispheres. At present reasonably adequate data exist only for the lower atmosphere in the Northern Hemisphere.

As with meteorology, studies of the ionosphere—necessary for improvements in radio transmission—require international collaboration. Each of the other fields in the program is characterized by similar needs for simultaneous worldwide measurements; and, since these fields are also interrelated in a complex way, the value of such data in one field enhances, and is enhanced by, the data in all the others.

The United States program has been prepared by the United States National Committee for the IGY established by the National Academy of Sciences—National Research Council, as the adhering United States body to the International Council of Scientific Unions. The Academy turned to the National Science Foundation in December 1953 as the logical Federal agency for the securing and administering of Government funds for this activity, which has many broad national values and implications and which is of particular interest to the Government.

The total budget approved by the Bureau of the Budget for support of the United States program is $13 million. Of this the Bureau of the Budget has recommended that $2,500,000 be appropriated for the coming fiscal year (1955) to permit the purchase of scientific equipment having long lead-time and for further planning of the program; the remaining $10,500,000 will be needed in fiscal year 1956.

The Government has many interests in the International Geophysical Year program. To some extent these interests relate to the general national welfare where the implications of geophysical research to weather forecasting, radio communications and navigation, mapping and surveying, and upper atmosphere flight are apparent. These interests relate to commerce, industry, and agriculture. These interests also relate to our national defenses: The atmosphere, particularly the upper atmosphere, grows steadily in importance.

In several of these areas the various executive departments have appreciable responsibilities and interests. The Office of Defense Mobilization, with scientific advisory functions and with responsibility for telecommunications policy, has commented on the value of the IGY effort from these points of view. The defense interests and implications are recognized by the Department of Defense. The State Department has endorsed the program from the international relations point of view. The Department of Commerce, with operational interests in weather and radio propagation and with overall business and industry interests has also endorsed this program and, like the Department of Defense, will participate in its execution.

Beyond its specific scientific and technologic aspects, the International Geophysical Year program also has broad international aspects. It affords, for example, an opportunity for world leadership by the United States in keeping with the President's often-expressed desires for international cooperation. In particular, the President recently expressed his hope for international cooperation in the peaceful uses of atomic energy. With respect to science itself, the President on March 17, 1954, stressed the vital role of science to the Nation. The International Geophysical Year in effect presents immediately at hand an international cooperative program in science; it is a program that is destined to go ahead and to succeed; and it affords an opportunity for the United States to assume world leadership in a constructive program of benefit to all.

THE TEXAS CO.,
New York 17, N. Y., June 18, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Committee on Government Operations,
House of Representatives, Washington, D. C.

DEAR MR. RIEHLMAN: This will acknowledge receipt of your letter of May 28 in regard to the work of your subcommittee which is investigating the operations of various scientific research and development activities in the Department of Defense. I will be very happy to discuss the matter with you and will arrange to come to Washington on a date which will be mutually convenient to both of us. Further, I would be glad to express my views to your subcommittee if you so desire. In your letter of May 28, you have raised five questions. I would appreciate the opportunity of informally discussing the matter with you or someone that you designate prior to appearing before the subcommittee in order that I may more clearly understand the problems that you are considering. For this reason, I would defer comments specifically on the five points.

It seems in order, however, to state certain general principles in which I believe in regard to research and development activities carried on by government, industry, and academic institutions. These are very fundamental principles and they will be reflected in the answers that I will probably give to the specific questions you have raised.

Certain research activities can be properly sponsored by Government participation. Basically, it is my opinion that Government participation in research should be kept at a minimum. In the field of modern weapon developments which are required to maintain the defense of our country and our world position at the proper level, it is necessary that the Government support most of the projects. Further, since this type of development requires field testing, it is apparent that participation by the armed service group is necessary to properly field test the device.

On the other hand, for the manufacture of materials or for methods of manufacture which are logically in the fields of industrial organization, even sponsorship by the Government agency is undesirable. In a few cases, developments may be needed and if they are not forthcoming through normal competitive pressures, a Government subsidy may be required. Industry has a responsibility along these lines and should avoid subsidization as much as possible. If industry is properly organized, there should be very little work in this category.

In respect to Government participation in research, I would say that it is preferable in most instances that the work be done by an industrial or academic laboratory. The laboratory selected for this work should have a record of successful specialization in the field of endeavor that may be involved. It would appear to me to be impossible for the Government to provide specialized training, all the necessary experience in scientific skills and the right type of managerial supervision in all the situations that might be involved. This training experience and skill is available by proper selection in either or both industrial or academic laboratories.

I have indicated herein my thinking in regard to the major problem with which you are concerned. I will be glad to explore in more detail the problem that confronts you and can assure you that I will give you as constructive an answer as possible.

Yours very truly,

W. E. KUHN.

CALIFORNIA INSTITUTE OF TECHNOLOGY,
W. K. KELLOGG RADIATION LABORATORY,
Pasadena, June 7, 1954.

Hon. R. WALTER RIEHLMAN,
House of Representatives, Washington 25, D. C.

DEAR MR. RIEHLMAN: I have received your letter of May 27 and, as you state, it is by no means a modest request. You have certainly undertaken a most difficult task, but an important one, and one which concerns all of us very much. I do not pretend to know the general answer to the problem and in fact I do not believe that there is a single pattern that fits all cases. Nevertheless, I am happy to give you some comments for what they are worth, and then I shall try to answer your specific questions as well as I can.

Your inquiry relates to "the operation of various scientific research and development programs in the Department of Defense" and I want to make it clear that my comments refer to this subject only, and not to what is generally meant by scientific research. This is an important distinction, for in the latter field freedom of investigation is the first requirement, and direction must be kept to a minimum. In military development the opposite is true, and planning and directions must be as clear as possible. Our aim must be clearly stated, the programs must be sound and understood, and the mission of any organization must be clearly defined. I do not wish to imply that scientific research should not be encouraged in our military laboratories. This would be fatal to their vitality, but their primary function is to produce hardware and if this hardware is useful and important to our national security you can expect people to be enthusiastic about their jobs. If the programs are not sound, nothing can make people do their best. This, I think, is much more important than the particular type of organization that is chosen for a particular purpose.

I shall try to answer at least some of your numbered questions.

1. I do not think there is anything inherent in military organization that is incompatible with the administration of military development programs. However, military men are trained to fight, and I do not think we can afford to use them where their training is not fully utilized. Also, the common practice of rotation is often detrimental to the stability and continuity of development programs.

2. This is pretty well covered by the previous statement.

3. I do not think that it would be desirable to establish a civilian organization to administer military research and development programs. In any case, there must be considerable military participation not only to inject the military point of view, but also to develop in the Armed Forces a better understanding of technical problems and possibilities and the optimum employment of technically complex equipment in war.

4. The Naval Ordnance Laboratory in Washington and the naval ordnance test station at Inyokern are examples of this kind of operation. Military support activities are under a military commander while the responsibility for the technical programs is delegated to a civilian technical director. The technical staff is largely civilians, but qualified officers are equally eligible, when suitable positions are available. This system has not always been an unqualified success, but I believe it is workable, and probably the best that has been devised so far.

5. The extent to which the Department of Defense should contract with nongovernmental institutions for military development will depend on the subject matter. Where there is a well-developed civilian industry, such as in the field of transportation or communication, most of the work should be done by industry. In other fields, such as armament, some in-house development seems to me highly desirable.

I realize that the foregoing is not a very complete treatment and may not be very helpful to you, but I am sure that you have access to many people who have had much more direct experience and who therefore can be more helpful to your committee.

Sincerely yours,

CHARLES C. LAURITSEN.

GENERAL ELECTRIC CO.,
RESEARCH LABORATORY,
Schenectady, N. Y., June 10, 1954.

Hon. R. WALTER RIEHLMAN,
Military Operations Subcommittee
of the Committee on Government Operations,
House of Representatives, Washington, D. C.

DEAR MR. RIEHLMAN: I have before me your letter of May 28, explaining briefly the nature of your subcommittee inquiry into operations of various research and development programs in the Department of Defense. The problems you are facing are certainly challenging and I am very pleased to see that you are making a really thoughtful and realistic study of them.

You have indicated five generalized questions dealing mostly with methods of obtaining an optimum organization structure for carrying on military research and development. Since these questions are quite involved, I have taken the liberty of discussing them briefly with other department managers in the research laboratory. Comments on these questions follow, though I hasten to point out

that in most cases a principle has not been provided which will determine an optimum solution.

You ask:

1. Are there any characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development?

Of course, if one looks hard enough at any research and development program, characteristics will usually be found which may retard effective technical work. In the case of military organizations, certain characteristics tend to make a research and development program less effective than might be desired. These may not be inherent, but it seems to me are likely.

(*a*) The objectives of a research and development program controlled by a military organization are more likely to lean toward development and away from research. Military people seem more likely to back development than research, because it is easier to visualize the end product and also its impact on military effectiveness. The freedom of inquiry which is so necessary to an effective research program is, therefore, likely to be suppressed. In other words, a program designed by military people is likely to be short range in nature, and too prescribed in scope.

(*b*) Military control in the past has tended to stifle research and development by not permitting adequate publication of results and interchange of technical information between groups engaged in work in the same general technical field. To be sure, classified information must always be carefully handled, but the balance between the technical losses possibly suffered by publication and the technical advantages obtained by strengthening the organization through publications and especially through contacts with other groups should be skillfully determined. It is my opinion that the civilian-controlled research groups have tended to handle this balance better than the military-controlled organizations, particularly better from the standpoint of the key research personnel who substantially control the work of the organization. Where publications just cannot be allowed, for reasons of security, it is important to provide alternate means whereby a scientist and his contributions can be made known to the top scientists in his field. Because these top scientists have tended toward civilian occupations, this has often been easier in civilian-controlled organizations.

(*c*) The traditional selection, training, and promotion of military men has not until very recently recognized the role of technology and research. The momentum of this traditional organization has made it difficult for science to achieve its proper stature. The chief difficulties have been the inability for scientists to acquire a sufficiently important position in the military organization and the inability to achieve continuity of program. This latter point is absolutely essential in an effective research program. The tree of research may not bear fruit for many years, and during these years the continuity of program, policy, and personnel virtually determines the success or failure of the entire effort.

(*d*) The various accounting procedures now required in military organizations tend to discourage scientific advance. Budgets spent for research tend to be handled by people who like to know in advance what results will be obtained. The very nature of research shows that one cannot predict the results to be obtained. The requirements of writing chronological reports on scientific work, whether or not useful results are obtained, is often distasteful and time-consuming to the scientist. In my opinion, these necessary details are handled by civilian organizations more satisfactorily than by the military. Perhaps fundamentally this is because science has not achieved its proper stature in the military and, therefore, scientific matters are likely to be administered by people insensitive to the scientist and unsympathetic to the nature of research.

2. Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?

Effective work from scientists requires the establishment of a particular "climate." Factors in this climate which, in my opinion, have been better handled by civilian-controlled research groups are:

(*a*) Freedom of inquiry.

(*b*) Stimulation from other scientists.

(*c*) Ability to achieve recognition from at least the top scientists in his field.

(*d*) Continuity of policy and program.

(*e*) Management which is sympathetic to the scientist and which recognizes the importance of scientific long-range research.

All of these factors are very important in obtaining an effective long-range research program.

3. Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?

Probably desirable, but I would not know the optimum organizational form. In wartime, organizations such as the radiation laboratory at M. I. T. were very successful, and probably the military participation was quite adequate, but in peacetime, I doubt that such a civilian group could be held together. I tend to believe that smaller civilian-headed groups with more limited scope of work may be more successful and stable. However, the danger is that organizations too small may die from lack of self-stimulation. In any case, it seems to me that the optimum degree of military participation is variable and depends primarily on the state of the technical art (degree to which equipment development is possible) and the importance of the ultimate military end product.

Until a reasonable proportion of top scientists can be found in the military, I would tend to think that the required research programs should be attached to the universities or industrial laboratories. Top scientists can be obtained at present in Government institutions on a temporary basis (for a year or two) but will not, in general, stay permanently.

4. Would it be feasible to organize military research and development programs in such a way that the technical activities capable of being performed by a civilian organization could be separated from those which are purely military, such as support functions? Where military support activities are necessary in connection with a research and development project, and such activities must be under a military commander, does it necessarily follow that the technical research and development functions must also be under direct military supervision?

I presume that you mean by military support functions, activities such as field trials to determine military feasibility of a technical idea or to obtain operational information affecting technical design. I think that evaluation and testing of technical equipments is a military function in which research and development people should play an advisory or consulting role. In preliminary field trials of new technical devices, perhaps research and development plays the dominant role with military operations as advisory. In any case, I think that many technical activities can be broken off from purely military functions and given to civilian groups. Where this can be done, it is probably very desirable if for no other reason than to tap the scientific personnel in existing civilian groups. I do not believe that research and development functions in connection with military support activities need be under direct military supervision; in fact, it is probably undesirable.

5. To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs? To what extent should private, nonprofit institutions participate? To what extent should private industry participate? How much in-house research is required for the military services to be capable of exercising qualitative control over research and development conducted by outside laboratories?

I do not know how to determine the best division of research. Some in-house research is certainly required in areas where relatively large and specialized groups are required, and which do not exist in nongovernmental institutions. However, our national scientific resources are now mainly in nongovernmental institutions and, in the best interests of our national defense, these sources should be tapped.

A very serious problem raised by this question is the proper monitoring of research. You imply that in-house research is required for the purpose of exercising qualitative control over outside research. In my opinion, this idea is valid only if the quality of in-house research people who are judging the outside work is high. It does not depend on the quantity of in-house activity. I have had many experiences with military "scientists" who have a small in-house program of research going, and who are simply incapable of judging that field of work. Research monitoring should be done by people who understand the nature of research and who have some experience with judging the possible and probable results.

I do not plan at the moment to be in Washington in the very near future, but should one of your staff wish to discuss this problem with me more fully here in Schenectady, I would be happy to oblige.

Sincerely yours,

JAMES L. LAWSON.

INDIAN HEAD, MD., *July 23, 1954.*

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee
of the Committee on Government Operations,
Congress of the United States, Washington, D. C.

DEAR SIR: I have received your letter of July 8, 1954, in which you request my opinion concerning important problems related to research and development programs within the Department of Defense.

I appreciate this opportunity, and sincerely hope that my comments, together with those of other scientists, scientific administrators, and military personnel, will aid you in arriving at some solution to this critical problem.

On comparing my experience in research and development at military installations with my experience in industrial laboratories and academic institutions, I must admit that much of the effort under military direction appears to have been ineffectual. The poor return on the military directed defense research effort is even more startling when one considers the abundance of facilities, the money spent, and the numbers of people involved in defense research at military installations, as contrasted to the limited budgets, low salaries, and few full-time scientists available for research in the universities.

There is a fundamental difference between the rank-conscious attitude of a military post commander and that of a vice president or director of research in a corporation, or the head of a university scientific department.

The usual commanding officer is trained, and properly so, to direct men subject to commands in military situations, and to perform essentially housekeeping duties. In defense research he is assigned, on a rotation of duty basis, responsibility for and control over highly trained civilian scientists and engineers, engaged in scientific effort. As a general rule, the commanding officer delegates his authority over security, inteligence, procurement, fiscal control, safety, service work, facilities design, civilian personnel and discipline, travel, attendance at scientific meetings, budget, machine shops, transportation, etc., to military subordinates such that the research group finds itself dependent upon the decision of numerous poorly qualified and temporarily assigned military personnel, each representing the commanding officer. Every regulation is binding upon the military officer, is interpreted to be binding upon civilians also. Such a situation leads to extreme inflexibility of a type completely incompatible with effective research activity.

Military officers usually have demonstrated little or no understanding of the scientific method, nor of the scientific aspects of the effort over which they have been assigned authority. Responsibility, without the necessary authority, is assigned to civilian "directors" who, as a result of their lack of authority, often find themselves unable to implement the research and development program.

The research vice president or director of a corporation is chosen on the basis of scientific and administrative qualifications, usually on the recommendation of individuals considered as competent to evaluate his qualifications. Almost invariably the evaluation is on the basis of scientific and managerial achievement as evidenced by publications, honors, or demonstrated ability to direct scientific effort. Industrial directors so chosen are retained and rewarded on the basis of the contribution of their organization. Every effort is made to expedite scientific achievement, even though regulations may have to be suspended or changed.

The modern industrial research director is given the authority required for the discharge of his responsibility not because of any a priori theory, but because it has been demonstrated as the most dependable way to get the job done.

In my industrial and academic experience, I found that it was necessary to justify the procurement of materials and equipment or the attendance at a scientific meeting to the research director only. In defense establishments such a simple matter as attendance at a meeting or attendance at a course has gone through channels as high as the Secretary of the service, and routinely to the chief of the bureau or corps. The director of research is regarded merely as an agent, not the representative, of the commanding officer. The director of research cannot send a man off the station without written approval from the executive officer who represents the commanding officer. At the naval powder factory, military permission must be obtained, after "justification" (and often rejustification) by the director of research and development, in order to send a scientist 22 miles on a scientific matter.

I believe that the prevailing poor morale of scientists in the Department of Defense could be vastly improved by assigning the authority now exercised by

installation commanders to properly qualified civilians. The general opinion is that military officers may be qualified in purely military matters but that they perform no useful function in a research and development organization.

In closing, I would suggest the following for the committee's consideration: The practices and methods used in industrial and academic research administration (which have made the United States the world's greatest industrial power) are applicable to research and development for the defense of the country. The Secretary of Defense would do well to study the most modern industrial practices, and endeavor to adapt this type of organization to defense research, development and production; such organization must be divorced from direct military or bureaucratic control and should be coordinated at the Department of Defense level. I suggest a Department of Defense Research with a Secretary reporting to the Secretary of Defense.

Where the objective is to obtain information of a fundamental nature it is possible that the degree of freedom should be approximately that of the university. Possibly this type of effort should be done by universities, under contract with a Department of Defense Research Board.

It is understood that such freedom is actually allowed in the United States Bureau of Standards, the United States Bureau of Mines, the United States Public Health Service, and, to a lesser extent, in the Department of Agriculture.

I wish to express my appreciation of this opportunity to make my observations known. If I can be of further assistance I shall be happy to cooperate in any way that I can.

Sincerely,

LAURENCE L. LAYTON, Ph. D.,
Associate Director, Research and Development, United States Naval Powder Factory.

JULY 15, 1954.

To: Dr. L. L. Layton, Associate Director, Research and Development
From: A. Owyang
Subject: Military direction of defense research (forwarded at your request)

1. Due to rotation of duty there is always a disruption, discontinuity and change in direction in research program.
2. Guidance, concept and local policy change with change of command.
3. Military traditions prevent lower rank personnel from having basic disagreement.
4. Frequently maintain short-range program and concern only with immediate and/or direct application.
5. Overly security conscious in free exchange of technical information.

UNITED STATES NAVAL ORDNANCE TEST STATION, INYOKERN,
China Lake, Calif., July 21, 1954.

Mr. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee of the
Committee on Government Operations, House of Representatives,
Congress of the United States, Washington, D. C.

MY DEAR MR. CHAIRMAN: In response to your invitation to submit to the Military Operations Subcommittee a statement on what are considered to be important problems in the guidance of the research and development program of the Department of Defense, the enclosed summary has been prepared. The opinions expressed in this statement may be held by others serving in similar capacities, but it is intended that they reflect my own observations without necessarily carrying the concurrence of the station or department which I serve.

Copies of two reports that are somewhat related to the question of your letter, and which were prepared by a group concerned with technical management of naval activities, are also enclosed. These problems have been relieved, however, and the reports are included only as background material.

It is a privilege to have this opportunity to support the work of the committee and I regret that a temporary absence from the station has delayed submission of the statement. Should amplification of this comment appear of interest to the committee, I could personally be available without delay through July 28, since I shall be at the Bureau of Ordnance, Navy Department, until that date.

Yours very truly,

F. E. LOWANCE,
Associate Technical Director.

STATEMENT BY F. E. LOWANCE FOR THE USE OF THE MILITARY OPERATIONS SUBCOMMITTEE, COMMITTEE ON GOVERNMENT OPERATIONS, HOUSE OF REPRESENTATIVES—IDENTIFICATION OF PROBLEMS THAT ARE BELIEVED TO BE INVOLVED IN THE EFFECTIVE GUIDANCE OF RESEARCH AND DEVELOPMENT IN THE DEFENSE DEPARTMENT

1. The assignment of weapons programs to the three services is marked by many instances of jurisdictional conflicts, unnecessary overlapping of responsibility, and deference to precedent without these having bearing on the military objectives. Granting gains due to RDB and the present Secretariat, and the effective work of many special groups such as WSEG, proper and logical assignment of programs seems to require more study and resulting organization.

2. Effective operation of the research and development program is under the management control of many groups and agencies who have no direct responsibility for the product. Some of the agencies are outside of the Defense Department, such as Civil Service, and some are internal as the Office of Industrial Relations and On-Site Survey Boards. While it is essential that such exist to give proper control and management guidance, in some instances their operation is in the hands of individuals with a negative viewpoint. The functions of such agencies seem to require better definition, and acceptance of responsibility for productivity on their part, which is essential, may result.

3. The operating stations of the Defense Department are subject to three major assignments, namely: (*a*) projects or tasks, (*b*) personnel ceilings, and (*c*) funds. These three assignments under the present methods of operation are not well coordinated. This should be improved at the program-planning level.

4. The tendency for military leaders to fail to recognize that the advances in human knowledge during the past few decades necessitate specialization. At a time when scientists, medical professions, lawyers, and others have recognized that specialization was demanded in order for the human intellect to maintain pace with the increase in information and knowledge, some of the military profession have insisted on providing professional officers with training that is supposed to equip them to direct research and development of the most complex type. This has resulted in stultifying programs because creative people cannot be guided (or retained) in the scientific professions by supervisors of shallow training and of technically inferior quality.

MERCK & CO., INC.,
Rahway, N. J., June 24, 1954.

HON. R. WALTER RIEHLMAN,
House of Representatives,
Washington 25, D. C.

MY DEAR MR. RIEHLMAN: Your letter of May 28 to me was of much interest, particularly in view of my service as a member of the Committee on Chemical Warfare of the former Research and Development Board during the years 1948–52. My contact with military research has largely been through my work on this Committee, first as an associate member, later as a full member, and in 1952 as Chairman of the Committee. In light of the above experience and also my experience in industrial research, I am happy to try to answer the questions raised in your letter.

1. Are there any characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development?—It seems to me there are no characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development, provided there is sympathy and understanding of each other's needs and problems by both the military men and the scientists. Inherently this is no more difficult of achievement than similar sympathy and understanding between business managements and scientists in industrial organizations.

2. Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?—Sometimes this is the case but fundamentally there is no more reason for this than with other government research and development organizations. Sometimes the civil service rules and rates of pay are not such as to attract the best scientists, but this is by no means always the case.

3. Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation

would be required to insure that military needs are being met?—Last year a considerable reorganization took place in the research and development activities of the Department of Defense with the abandonment of the Research and Development Board and the establishment of the Office of Assistant Secretary of Defense for Research and Development. In my opinion, sufficient time has not elapsed to know how well this organization will function. It should be given more time to prove its effectiveness. There are indications that it will operate more smoothly than the old RDB. If it is proved that this type of military research and development organization is not entirely satisfactory, your subcommittee may wish to give some thought to central line direction of research by the Department of Defense itself. On the other hand, I do not believe that central line direction of development work in the Department of Defense would be desirable. It seems to me that coordination of development work by the Department of Defense should be continued, but the responsibility for direction should remain in the separate services.

4. Would it be feasible to organize military research and development programs in such a way that the technical activities capable of being performed by a civilian organization could be separated from those which are purely military, such as support functions? Where military support activities are necessary in connection with a research and development project, and such activities must be under a military commander, does it necessarily follow that the technical research and development functions must also be under direct military supervision?—It seems to me that the military, the scientists, and the technical people generally should work very closely together on research and development programs. Sometimes a civilian is in a position to lead the program and sometimes a military man is, depending partly upon how close one is to the desired finished product. The further one is from ultimate utility, the more the civilian is in a position to lead. In general, the closer one is to the final objective, the more the military should take leadership since the military man will be the user of the ultimate product. It is not always necessary for a military commander to have direct supervision of research and development functions concerned with his command. However, he should be in a position to cooperate with and guide the scientists working on military problems toward ends which would be useful to his command.

In other words, it seems to me important to emphasize the value of close cooperation between the two, the scientists and technicians and the military, with one group leading in some phases of the program and the other leading in other phases of the program.

5. (a) To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs?—The Department of Defense should contract with nongovernmental institutions to carry on research and development programs to the fullest extent possible when the objective of the research might be expected to result in a product or process which would have peacetime, as well as military, use. Generally, such contracts should be made with industry since the Government later presumably would wish to purchase the resulting products from industry. The Government should contract with outside organizations to carry on research and development when it appears the product or process, which may result from the research and development work, will necessitate Government contact with industry for production of such products or the use of such processes. The Department of Defense should contract with non-Government institutions to carry on research and development programs whenever possible when it is clear that there are outside organizations which are peculiarly qualified from the point of view of personnel, facilities, etc., to carry on the program more effectively than the Government laboratories.

5. (b) To what extent should private, nonprofit institutions participate?—It seems to me that participation of private, nonprofit institutions in military research should vary, depending upon the purpose of the institution. In general, the participation of educational institutions in military research which must be classified, in my opinion, is questionable during normal times since the purpose of such institutions is the training of students and the spreading of knowledge. The requirements of military security interfere with this purpose. In times of grave emergency and in times of war, it seems to me civilian institutions, such as the educational institution, should quite properly be expected to contribute to the military research and development program.

5. (c) To what extent should private industry participate?—In times of grave emergency and, of course, in war, industry should be expected to contribute to military research to the extent that the needs of the country demand. In normal peacetime, industry should be expected to contribute only to the extent that its

economic interest would justify, or when its peculiar facilities or manpower are essential to a particular project. Industry is particularly interested, and should be, in military research on new or old products which it is in a position to manufacture. It is also interested in developing new uses for products which it manufactures or is in a position to manufacture. It is also interested in research on new and improved methods of producing and transmitting energy. Such research normally would have peacetime, as well as wartime, importance.

5. (d) How much "in-house" research is required for the military services to be capable of exercising qualitative control over research and development conducted by outside laboratories?—Industry has found that important research and development for the organization should be carried on best in the laboratories of the industry. In my opinion, the same principle should apply to military research. Essentially, military phases of the research and development program should be carried on largely in military research and development laboratories and other facilities. The military organization is most concerned with, and interested in, such research and development. By such research I refer, for example, to research on new pieces of ordnance, new types of bombs, and so forth. Collateral and related research, which is needed in order to make possible the success of the research on a particular military weapon, such as development of a new type of steel and its properties, a new paint or whatnot, should be contracted out generally to other nonmilitary laboratories.

In my opinion, the problems of research and development for modern war are so enormous that the military research and development organization should make every effort to contract out all research that it reasonably can, maintaining, however, always a strong corps of people actively carrying on research and development on military projects in Government laboratories. In connection with the problem of morale, it would be desirable to give some thought to the operations of the civil-service system in the research and development organization of the Department of Defense and to its salary schedule to see if this should be modified to attract more able people.

Please let me know if there is anything further in this matter that you would like to have me do.

Sincerely yours,

RANDOLPH T. MAJOR.

THE UNIVERSITY OF ROCHESTER,
COLLEGE OF ARTS AND SCIENCE,
Rochester, N. Y., May 29, 1954.

Hon. R. WALTER RIEHLMAN,
Representative from New York,
Military Operations Subcommittee,
Committee on Government Operations,
House Office Building, Washington 25, D. C.

SIR: I have your letter of May 26 relative to operation of various scientific and development programs in the Department of Defense. The five questions included in the letter are difficult to answer in a brief space. Some of them are not susceptible of definite answers because one can cite successful and unsuccessful operations which follow much the same pattern. In other words the competence of individuals is often the determining factor rather than the organization chart or the system.

I will give personal opinions about some of the questions but would wish to have it understood that these are just opinions for which unambiguous proof would be difficult to obtain.

1. Are there any characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development?

There are, in my opinion, two characteristics which make an effective operation difficult although not impossible. The first of these is connected with the frequent rotation of officers from one position to another. Research and development for modern warfare has become a highly specialized field. An officer who does not devote full time to such work for a long period is not in a position to make wise decisions. If he has not had advanced training in science or in engineering he cannot make many of the decisions rapidly and wisely. It would be possible to cite numerous examples of unnecessary expenditures to conduct experiments for which the answers were either already known or which could not possibly lead to useful answers.

The second difficulty is connected with military rank. Any director of a research and development program must, for effective operation, be able to put the right persons in the right positions. This may, in some cases, mean that young men of low rank should be placed over older men of less ability. In a military framework this is often difficult. In fact civil-service regulations prove sometimes to be a handicap but such regulations can be lived with more easily than military protocol.

2. Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?

I believe the answer to this question is an unqualified "Yes." One of the difficulties is related to those referred to in question 1, i. e., that of obtaining competent direction for a program when military rank must be considered. The greatest difficulty is, however, in wasting time of scientific personnel in trying to educate a lot of persons in higher echelons who by their training cannot be expected to understand the program. There tends to be too much superstructure in a military organization. The ratio of workers at the laboratory bench to administrators is often too low.

There can be no doubt that the average scientist in the United States does not want to work full time for the military in peacetime. If he does he usually feels a sense of frustration because he feels, righly or wrongly, that he is called upon to do a lot of unnecessary rush work which takes attention away from the main objectives. Sometimes military orders are issued to do things which make no sense from a scientific standpoint.

3. Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?

This is a difficult question to answer. The American tradition has been not to have such a civilian organization. Other countries have done things in different ways with varying degrees of success. There can be no question that the Office of Scientific Research and Development during the war permitted some things to be done which would have been vetoed by the Military Establishment. On the other hand if OSRD had been in existence for many years it too might have gotten into a rut. I do not believe the best answer is found in numerous civilian committees and boards which review military research and development programs.

I would give a qualified "Yes" to the first part of this question provided salaries are fixed at a level which will insure competent direction and prosecution of the program. If some of the branches such as Department of Ordnance, Signal Corps, Chemical Corps, Air Research and Development Command, etc., were set up as civilian organizations and separated from troops and military functions I believe the result would be best in the end. There can be no doubt, however, that much time would be lost in making the change. The desirability of the step will depend to some extent on predictions about the next war. In my opinion it would be best at present and in view of present world conditions not to take such a drastic step but to separate research and development laboratories from military commands even though they are retained in the present branches of the service. Thus the technical directors would become civilians but still responsible to the chiefs of the various services. I would also arrange things so that certain activities are directly under the Department of Defense and not under the Army, Navy, or Air Force.

One can assume that a civilian may know just as much about military matters as an officer if he has studied the proper things. The contact with the using branches is not now all that should be desired. The essential thing is not to have complete military control over programs because the unorthodox often provides the arms for the future. There would seem to be no answer to the second part of the question but to put the right men in the right places. Some civilians got along well with the military during the war and others did not.

4. The answer to your fourth question is "Yes" in my opinion. I believe a separation between the military functions and the civilian functions is possible and desirable. I do not believe I can answer these questions in a few lines but I think a suitable structure could be worked out.

5. To what extent should the Department of Defense contract with non-governmental institutions to carry on military research and development programs?

The Military Establishment has not become accustomed to use of contracts to perform research and development on whole programs. The Atomic Energy

Commission has shown that this can be done but the placement of responsibility on the contractor must be greater than is usual in the Military Establishment. I do not believe the system will work if the present tight control of research contracts is continued. The contract method of doing research has some advantages in freedom to hire and fire and to pay salaries based on merit.

My answer to this question is, therefore, that much research and development can and perhaps should be done this way but that a fundamental change in philosophy would be required to make such a system work.

I do come to Washington fairly frequently and will be happy to talk with your staff members. This always is a busy time of the year for professors so that my next trip will probably not be until the end of June.

Very sincerely yours,

W. ALBERT NOYES, Jr.

THE INSTITUTE FOR ADVANCED STUDY,
Princeton, N. J., May 28, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Congress of the United States, Washington, D. C.

DEAR MR. RIEHLMAN: Thank you for your good letter of May 26. The questions you ask, and the general subject of inquiry of the Military Operations Subcommittee are of great interest to me, and to some of these matters I have given a little thought. It would be very helpful for me to talk over with a member of your staff the experiences that I have had, and the conclusions that are suggested by them. It is not certain that I shall be in Washington within the next week, but I shall be glad to consult with a member of your staff here at Princeton at any time that we may arrange.

In quite general terms, military establishments have been frequently and outstandingly successful in the management of research and development. This has not been uniformly the case, and we all know of many serious inadequacies; but where the military establishments have been successful it has been because they themselves have understood that military organization, as required by the line or staff functions of the services, was not appropriate for research; because the military, in short, created essentially civilian laboratories and development centers, and brought to this task enthusiasm and understanding. The Naval Ordnance Test Station at Inyokern and the Naval Research Laboratory are two outstanding examples.

We had a somewhat similar arrangement during the war at Los Alamos, which was an Army post, and where military personnel served at all levels in the laboratory in complete harmony with civilians, and in the case of senior personnel, providing indispensable insight and liaison with regard to military problems. It is true that this laboratory, then as now, has been operated under contract with a university. It is probably—though in this I may be prejudiced—the best laboratory in the country working on military problems. It has never been run as a military organization, but it has always, from first to last, been in the closest possible touch, in matters of policy, of training, of test operations, and of equipment, with the military services.

My own experience would thus lead me to the view that either the military departments, or a civilian agency, could establish research institutions of very high quality; and that if they do not always do so this is not necessarily inherent in the fundamental assignment of responsibility.

Nevertheless, I would not wish to foreclose the possibility that the civilian organization could play a vital part. That was certainly true during the last war of the Office of Scientific Research and Development; it may well be true today, or in the more critical times that may lie ahead. The basic reason lies not, I think, in the distinction between military and civilian sponsorship, but in the fact that an emergency can call forth greater talent, greater freedom, and greater flexibility than we can hope to find in laboratories of long standing and rather fixed ways. The experience of the last war, and such experience as I have known since, suggest that the problem of harmonizing the work of civil sponsored and civilian manned laboratories with combat and its requirements, though never an easy problem, is soluble when men of skill and devotion are faced with a real need and a real opportunity.

It will be clear from these comments that I favor contracts by the Department of Defense with nongovernmental institutions, with the one warning that these should be so undertaken as not to destroy or cripple the basic long-term functions

of those institutions except in dire emergency. Universities can play a great part in furthering military research; but they should not sacrifice for this their work in basic study and training and teaching except at those moments and for those undertakings which are indeed decisive for the survival of the Republic.

Very sincerely,

ROBERT OPPENHEIMER.

UNIVERSITY OF CALIFORNIA,
DEPARTMENT OF CHEMISTRY AND CHEMICAL ENGINEERING,
Berkeley, Calif., June 28, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
House Office Building, Washington, D. C.

DEAR CONGRESSMAN RIEHLMAN: This is written in response to your letter of May 27 as amplified by a telephone conversation with your staff when I was in Washington recently. As you know, my primary experience related to military research has been specifically connected with the wartime Office of Strategic Services and later and more extensively with the Atomic Energy Commission. In the former case I was technical director of a laboratory operated under contract for the OSS problems; in the latter case I was the research director within the AEC organization dealing with the laboratories which likewise operated under contract. In both cases I served on leave of absence from my university position. In these duties I have had many contacts with regular Defense Department laboratories and some contact with the corresponding British establishments.

My comments can be organized under three topics, as follows: (1) Contractor versus direct operation, (2) civilian versus military control, and (3) personnel policies for scientists and engineers.

(1) The contract mechanism serves to separate the actual laboratory operation from both the detailed regulations of the Federal Government and from such immediate contact with the sponsoring organization. This has many advantages for the long-range exploratory work and for large specific development tasks which can be clearly defined in a contract. Under this setup the technical men have optimum freedom to attack a broadly defined problem in the best manner and to adjust the day-to-day program in accordance with new developments.

The proper contact with the sponsoring service is that of liaison and infrequent modification of the contract. This sort of relationship arises naturally. The contractor method presumes the existence of a responsible corporation, industrial or academic, to supervise the work. My experience indicates that at least one such organization is usually available for any task but that the continuing interest of the top management needs to be assured in each case. Academic contractors are usually adapted to long-range exploration assignments whereas industrial contractors may best take definite development tasks; however, I know of many very successful exceptions to these rules.

There remains a need for laboratories or other establishments to handle a miscellaneous variety of research and development work which is more closely integrated with operations. This includes troubleshooting and improvements for existing weapons systems. It also includes research programs which cannot be outlined in broad terms in advance but rather must be coordinated closely with the details of the military need. While these activities can be handled through contractor-operated facilities (I have done so successfully for similar AEC problems), nevertheless the advantages of the contract mechanism are largely lost.

In summary of part (1), I would recommend more extensive use of the contract mechanism for the operation of Defense Department research and development work (including the operation of some major laboratories) but I also recognize the advantage of continuing a substantial program of direct Government operation.

(2) The most pertinent information on civilian versus military control can be found by comparing British and American operations. Typically, a British military research establishment has a civilian superintendent in general charge with a high military officer subordinate to the superintendent. This officer commands all other military personnel on the post. The usual military rotation system may change the military personnel frequently but this rotation does not disturb the actual scientific operations. The civilian superintendent reports to the top organization, i. e., the Cabinet Minister or his immediate subordinates who are civilians.

In the present American pattern there is a military officer in general charge of each establishment, but in view of his previous experience he cannot possibly have

the background to actually direct the work. Thus he is expected to let the top civilian run the scientific operations. This is an abnormal relationship which can be successful only if unusual tact and understanding are present on both sides. It is a fine commentary on our many excellent men that this method has worked as well as it has at many locations. I believe, however, that it is fundamentally wrong and that it should be changed to either the civilian superintendent pattern outlined above or a scheme to be suggested below.

(3) The effective use of scientists and engineers in our Military Establishment is actually a broader problem than the operation of our laboratories. There is also need for technical men in staff duty at all of the higher command levels. In addition to the training of operators and maintenance men for our complex military equipment, there is also need for imaginative staff officers who can suggest new uses and can solve difficulties of a more fundamental sort. It is too much to expect a regular line officer to perform this duty even after special training. Just as the medical services need to be handled by professional medical men, likewise the scientific and engineering work needs to be supervised in the field by professional scientists and engineers.

For these reasons I believe very serious consideration should be given to the formation of a Scientific Corps somewhat analogous to the Medical Corps. This unit should be limited to men of full professional standing in science or in engineering. It should not include those trained merely in the immediate areas which might be termed "military engineering." Members of this corps should shift between civilian and military status as their assignment shifts between laboratories and military units. There should be reservists as well as career officers.

If such a Scientific Corps were established, then the top management of military laboratories might well be drawn from this corps. Likewise lower ranking members of the corps could be assigned in rotation to laboratory positions and to staff duty in regular military units. However, the frequency of such rotation should be determined by the head of the Scientific Corps rather than by regular military personnel policy. Also it should be understood that, like the Medical Corps, there would be need for direct commissioning of officers at high levels in the Scientific Corps in time of emergency.

I have given only a very brief outline of this concept of a Scientific Corps but I believe it deserves very serious attention on your part at this time.

I appreciate your invitation to comment on these problems and I hope that your study proves to be fruitful.

Yours very sincerely,

K. S. PITZER,
Dean, College of Chemistry.

THE FORD FOUNDATION,
New York, N. Y., June 1, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Subcommittee on Military Operations
of the Committee on Government Operations,
House of Representatives, Washington, D. C.

MY DEAR MR. CHAIRMAN: I am glad to be of any help that I can to your subcommittee as it undertakes to inquire into the scientific research and development programs in the Department of Defense.

The questions asked in your letter of May 26 are broad enough so that I think it would be better for me to have a conversation with one of your staff members than to try to write a paper on the subject.

If any of your staff is coming to New York for any other purpose, it would be somewhat more convenient for me to see him here. However, I will be glad to come to Washington if that seems to be the best arrangement. While I would be glad to adjust my time to the convenience of the subcommittee, I would suggest Friday, June 11, or the morning of Monday, June 14, as the most convenient for me, as I expect to be in Washington over the weekend between those 2 days.

The New York University Press is about to publish a series of lectures which I gave last fall on the subject of Government and Science. These lectures were written before I joined the staff of the Ford Foundation. I have dealt with some of the questions asked in your letter, particularly in the third and fifth chapters. I will ask the New York University Press to send you a prepublication copy of the book, with the idea that some member of your subcommittee staff might be interested in reading the chapters in question before I visit him.

I think I should mention in advance that I am not a physical scientist and my experience in the Department of Defense did not put me closely in touch with the immediate administration of research laboratories. This, however, is not the

level to which most of your questions seem to be directed, and if my general administrative experience will be of any help to your staff, I will be glad to do anything I can to cooperate.

Yours sincerely,

DON K. PRICE.

DOUGLAS AIRCRAFT CO., INC.,
Santa Monica, Calif., June 18, 1954.

Mr. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Committee on Government Operations,
House of Representatives, Washington, D. C.

DEAR MR. RIEHLMAN: As you can see from the enclosed envelopes, your letter of May 27 was forwarded to me in Washington, where I was at the time, but missed me and has only now been returned.

I doubt whether I can be of much assistance to you. The questions you raise are most difficult to answer in specific terms and I am frankly stumped by some of them. I simply do not know how to answer these in any way that offers constructive suggestions. Perhaps I can do best by simply backing off and taking a long view of the situation as I see it.

Military research and development in this day and age is necessarily a complicated matter. It cannot, of course, be handled entirely by either the military or civilians. There must be not only efficient prosecution of the work itself; there must also be continuous review of what should be done and what can be done.

It was recognized rather clearly at the end of the war that this required the close association of three elements, the military services, industry, and the civilian scientists. The importance of considering weapons as integral parts of systems, and of bringing to bear upon the problems of military operation the latest analytical techniques was also recognized. In an attempt to enlist the aid of all competent people, wherever they might be, the educational institutions and private research laboratories were brought in, civilian advisers were signed up, organizations such as the Research and Development Board, the Weapons Systems Evaluation Board, the Scientific Advisory Board, RAND, and the Air Force Research and Development Command were formed. Huge Government laboratories such as Tullahoma were started.

It is inevitable under such conditions that stresses and strains should develop. We have been trying to get three sorts of people to work closely together on common problems and settle into their particular roles and it has not been easy. In perspective some experiments have proved to be successful, others not so much so. Changes are being made as a result of this experience and improvements are underway.

I personally doubt whether this is the time for revolutionary new concepts, such as a civilian organization to administer research and development. Rather there should continue to be evolutionary modifications in the direction of a better balance of effort. The organization as a whole should be gradually shaken down and become more businesslike. I think this is what is actually happening.

Where have we overreached ourselves? Well, for one thing, review of military programs as a whole by civilians has in my opinion been overdone. The military is not as dumb as we civilians would sometimes like to think. Occasionally they need, and frankly seek, the assistance of civilians in reaching sensible decisions on starting, modifying, or stopping highly technical programs—but this is not universally so.

We must also seek a proper balance between standardization on the one hand and weapons systems on the other. Insistence upon the systems approach to the exclusion of all other requirements would cause costs to soar out of sight, whereas too much standardization inhibits progress.

And finally, the private nonprofit institutions should not be forced into development and production (nor for that matter be permitted to get into them) as has sometimes happened in the past. Their unique capability is in research and generally speaking that is what they prefer to do.

In each of the examples I have just cited, there has already been progress toward better balance and I do not know anything your subcommittee can or should do to accelerate it.

I shall not be in Washington until the middle of July but if anything I have said suggests a desire on your part for more (perish the thought) let me know.

Sincerely yours,

A. E. RAYMOND,
Vice President, Engineering.

HARVARD UNIVERSITY,
LYMAN LABORATORY OF PHYSICS,
Cambridge, Mass., June 23, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Congress of the United States, Washington, D. C.

DEAR MR. RIEHLMAN: I am sorry to be so late in replying to your letter of May 26, 1954, but I have been away for a considerable period of time. During one of these trips I did have an opportunity to discuss the subject of your letter with a member of your staff.

The questions which you raise in your letter are very real, very important, and very difficult ones. Although I have thought a great deal about these problems and have some definite ideas on them, I would like to emphasize that these ideas might be considerably modified if engaged in a thorough study along with others so that I might test the ideas out in extensive argument.

To avoid unnecessary repetition of your list of questions, I shall precede my comments with numerals that are identical with the numerals used in your questions.

1. There are indeed some inherent difficulties in military research which cannot be overcome by any means that I know. One of these is that from the point of view of a pure scientist almost all problems with military applications are relatively uninteresting scientifically. Although very good scientists will work on these problems enthusiastically for patriotic reasons, it is more difficult for them to maintain genuine scientific eagerness in these problems for long periods of time and in times of peace. Another inherent difficulty is that associated with security classification. Although security restrictions are indeed necessary and must be retained, they also necessarily impede scientific progress and interfere with the atmosphere under which research ordinarily best prospers.

2. In addition to the inherent difficulties, there are some characteristics of the military organization of research that tend to retard scientific development. One of these arises dominantly from the large size of the military organization and from the fact that enough delegation of authority is not provided to the laboratory directors. I believe that the members of many military laboratories find their work to be somewhat frustrating scientifically. This often arises from the delays in obtaining approval for new research programs as these requests for approval make their slow way through the military chain of command. This is in marked contrast to the situation, let us say, at my own university, where I can make very marked changes in my research program without seeking the approval of anyone. A second difficulty is that the research work in most military laboratories tends to be excessively programmatic with the programs often being assigned by higher authority. Since receiving your letter, I have had discussions with a recent graduate student who rejected a high-paying position in a military laboratory in favor of a much-lower-salary university job. He stated that the dominant reasons for his choice were the excessive programmatic character of the military research to which he would be assigned and his anticipated lack of research freedom in a military laboratory.

3. The question of a civilian organization to administer military research and development programs is a difficult one indeed. It is my own belief that it would be both unwise and unworkable to establish a civilian organization which took over all military research. I believe that the military commanders could correctly feel that they were deprived of the means to carry out their assigned responsibility if they had no research organizations over which they had control.

On the other hand, I think that considerable benefit might be derived from an additional small research organization operating in parallel with the military laboratories instead of replacing the latter. This organization should have contracting authority and should be authorized to initiate research programs in any field which appeared promising but should not have explicit and unique responsibilities other than the general responsibility of performing whatever research appeared to the organization to be the most promising for the military strength of the United States. Such an organization would indeed provide duplication for some of the existing military research. On the other hand, it should not be forgotten that in moderate amounts duplication in research is a virtue and not an evil.

4. I think the provision of a considerable amount of civilian scientific direction in a military laboratory is desirable. However, it is important that the best possible man be obtained to provide the direction. In general a better man can be found if he can have assurances of a fair amount of scientific freedom.

5. I believe that the Department of Defense should contract with nongovernmental institutions to carry on military research and development programs to a considerable extent and as far as appears advantageous. I believe that contracts with highly qualified individuals in nonprofit institutions in the long run are particularly effective provided the intrinsic interest of the research program is sufficiently great that first-rate individuals and institutions are attracted to it. On the other hand, I believe that a considerable amount of in-house research is required for the military services to be capable of providing suitable understanding and evaluation of research performed elsewhere.

Sincerely yours,

NORMAN F. RAMSEY.

TUCSON, ARIZ., *July 22, 1954.*

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Committee on Government Operations, Washington, D. C.

DEAR CONGRESSMAN RIEHLMAN: In accordance with your request, I am forwarding my thoughts on the subject under investigation by your subcommittee.

I am not a scientist and although I completed a 3-year postgraduate course in ordnance, I have been engaged in administrative work during the past 12½ years.

In my opinion, the most important problem confronting our military research and development program today is the recruitment and retention of experienced personnel for work in Government laboratories.

Defense Department research laboratories must compete for their employees in the open market against large corporations, many of whom have Government contracts. These corporations pay the Federal Government large sums in annual income taxes, thus they can pay larger salaries to attract and retain experienced personnel without too great an impact on their net earnings

To illustrate the demand for scientists and engineers, I am enclosing one page of "Help wanted, men" from the Los Angeles Times dated Monday, July 19, 1954.

It is realized that a few scientists may stay with a given project because of their interest in a particular type of scientific endeavor, nonetheless the young scientist or engineer is human and in the vast majority of cases is interested in the size of his monthly paycheck.

It is realized that pay schedules for class IV–b civil-service employees are established by the Congress. I am not recommending that the basic pay scales be increased, but I do recommend that the Defense Department be given more latitude in the classification and fringe benefit areas similar to that enjoyed by the Atomic Energy Commission. For example, the University of California operating at Los Alamos under contract with the AEC may pay expenses of a prospective employee to Los Alamos for interview and return to his home. The procedure has a twofold advantage: (1) It permits a thorough interview and sizing up of the prospective employee by supervisory personnel and it allows the applicant an opportunity to determine whether he believes that the type of work on which he is about to enter is stimulating and challenging. In addition, it gives the prospective employee a chance to look over housing, schools and community life, and to determine whether his wife and family will be happy in their new surroundings.

Secondly, I believe that the environment in which the scientist or engineer works should be as free as possible from military regimentation. The Bell Laboratories under Dr. Mervyn Kelly have, I believe, set up very satisfactory working arrangements of supervision, evaluation and opportunity for advancement for their employees.

I believe that the subject of direction and evaluation should be stressed in order to keep projects moving toward the goals which have been established. It is further suggested that a certain amount of project money, say 10 percent, be set aside to be expended on research in the field of pure science. The research department of the General Electric Co. under Dr. Steinmetz established this policy many years ago, and I believe the company has continued the policy, so it must have been considered worth while from both the company's and the employee's point of view.

As your committee is well aware, many Government laboratories under the AEC and the Defense Department were established in isolated areas during World War II. In order to provide homes for employees the Government built the houses and rented them to the employees. Thus a company town was established with the Defense Department in the role of employer and landlord. The AEC has studied the problem of selling houses to the employees. It is recommended that these studies be continued. The problem is especially difficult at stations under

military control due to conflicting interests, because military personnel on duty at a given station are entitled by law to Government housing, if available. It is recommended that at isolated stations, where suitable off-station communities do not exist, that a certain amount of land be made available for sale to Government employees for the purpose of building their own homes. This problem was partially solved by the Department of the Interior at Boulder City, Nev., by means of leasing a building lot to an employee for a term of years. In the latter case I agree the employee did not own the land in fee simple but the policy did allow him to build his own home. I believe that the above recommendation is important because I think that it is only natural that most ambitious young men look forward to the day in which they may own their own homes as means of setting up security for their old age or as a savings account for the immediate present. Home ownership in a community certainly tends to make an employee a more permanent citizen.

I know that your committee realizes that the problem of retaining qualified personnel in Government laboratories reduced to its simplest terms is one of supply and demand. At present scientists and engineers are in short supply. Note enclosure No. 2 in which a Canadian company is advertising for qualified personnel in the Los Angeles Times under date of July 16, 1954.

I believe the only solution of the problem lies in making working conditions and salary schedules in Government laboratories competitive with those established by private industry.

Sincerely yours,

J. O. RICHMOND,
Commander, United States Navy (Retired).

NEW YORK UNIVERSITY,
COLLEGE OF ENGINEERING,
University Heights, New York 53, N. Y., June 8, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Committee on Government Operations, Washington, D. C.

DEAR MR. RIEHLMAN: With further reference to your letter of May 26, and in consultation with some of my associates, I am appending hereto some brief answers to the inquiry which you propounded in your letter. You realize, of course, that one could write a real treatise on these subjects. I hope that this material may be useful to you.

Cordially yours,

THORNDIKE SAVILLE, *Dean.*

ANSWERS TO CONGRESSMAN RIEHLMAN'S QUESTIONS

1. There are certain characteristics in military organizations that militate against obtaining maximum effectiveness in a research and development program. These include:

(*a*) Rapid rotation of supervisory personnel.

(*b*) Inadequate salary scale for top positions.

(*c*) Undesirable working conditions which include (1) red tape, (2) restriction on attendance at technical meetings, (3) poor facilities in many instances, (4) strangling accounting practices, etc.

These could, no doubt, be rectified at least in part.

2. Items (*a*), (*b*), and (*c*) above all contribute to making it difficult to obtain and retain highly qualified personnel.

3. Any organization doing research for the military, must eventually report to the military to be certain that military needs are met. However, it would seem desirable to have the administrative group include both military and civilian personnel, so as to bring together the two points of view.

4. Research can best be handled by civilians, even in a military establishment. Final control and policy functions have to come under the military. It might be advantageous to have some procedure whereby quite large scale, expensive, or novel projects could be appealed (either pro or con) to an appropriate office not in the Defense Establishment, to assure against bureaucratic prejudice or fixed notions.

5. It is believed that there are valid reasons for the Department of Defense to employ nongovernmental institutions to carry on military research and development programs. Reasons for this follow:

(1) Educational and industrial research organizations are more successful in obtaining and retaining the best personnel.

(2) Educational institutions should participate in the program both for their contributions to the program itself and to help train research personnel. It should be noted that the atomic energy program started in the universities. Research is also usually conducted more economically in universities than by military establishments.

(3) Private industry should participate in the applied research and development program since they will have to produce the great bulk of the military material. Hence it would seem desirable to bring them into the program as early as possible so that they can contribute from their background of experience in production.

AMERICAN CYANAMID CO.,
New York, N. Y., June 11, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Committee on Government Operations,
House Office Building, Washington, D. C.

DEAR MR. CHAIRMAN: As one who has spent a great deal of time in Washington over the past 12 years, working as a consultant on research and development programs of the Quartermaster General, Rubber Director, Research and Development Board, and currently with Assistant Secretary of Defense (research and development), I am glad of the opportunity to give your committee my views on the questions raised in your communication of the 27th of May.

1. Are there any characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development?

I believe many research men would answer this in the affirmative, feeling that research and development in a Military Establishment must suffer from regimentation, but in my case after observing the administration of our military research and development programs and visiting many of our military research centers and facilities, I feel that as this work is being conducted today the administration problems, and of course there are many, just about parallel those that we have to deal with in industry.

2. Does the military organization of a research and development program tend to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel?

Retardation of research and development has, I believe, in the past, sometimes been caused by the lack of coordination of the work of the three military departments. Sometimes this has been due to poor communications, competitive attitudes, and even deliberate withholding of information. However, it is my observation that the cooperation between the three technical services improved greatly under the guidance of the Research and Development Board and I have every confidence that under the new organization set up to guide the military research and development program under the Assistant Secretary of Defense for Research and Development with the increased authority vested in the Assistant Secretary, there is no reason why the research and development of the military departments should in any way suffer from the fact that the programs are under the administration of a military organization.

As regards difficulty in obtaining and retaining the services of highly competent civilian scientific personnel, the military, like all other Government agencies, is under several handicaps; low civil-service salaries, especially in the upper grades and at administrative levels; low incentives to produce in peacetime and the demoralizing effect of the witch hunts. The military is in my opinion at a definite disadvantage from all these standpoints, when competing with industry for scientific talent.

3. Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?

My answer is "no." I believe our present system at our military research centers is working effectively. While at most of these facilities the CO is not a trained scientist, the man or men who direct the work are ordinarily well-trained scientists or engineers. The administrative ability of the military executive is usually an asset. An all-civilian administration would be too ignorant of military

requirements to guide the research and development program. With the large civilian contingent in the OASD—RD (Office of Assistant Secretary of Defense for Research and Development) together with the very large group of civilian panel consultants, and with the large civilian participation in the military research and development program through contract with universities, nonprofit organizations and industry, there is, in my opinion, all the civilian participation that is necessary or desirable.

4. Would it be desirable to establish a civilian organization to administer military research and development programs? If so, what degree of military participation would be required to insure that military needs are being met?

No; I do not think so and for the reasons given under 3. The work at civilian organizations is actually largely under the direction of the civilian heads of those organizations. The military tells them what they want done, but not how they shall do it. Even when it comes to prototypes and "hardware" the military specifies performance but the civilian designs and executes.

5. To what extent should the Department of Defense contract with nongovernmental institutions to carry on military research and development programs? To what extent should private industry participate? How much inhouse research is required for the military services to be capable of exercising qualitative control over research and development conducted by outside laboratories?

To the fullest extent that adequate facilities and competent personnel are available outside of Government installations, unless those facilities or competent personnel are already available in Government institutions. I would say that all three types of non-Government research institutions should be used, the choice depending only on competence in manpower and facilities.

There certainly must be adequate inhouse research competence to not only evaluate but also apply and extend the work of outside laboratories.

I believe it is clear from my comments that I believe our present military research is being well conducted and well coordinated. I am chiefly concerned about getting and holding competent men in our military-research centers. I have emphasized the noncompetitive salaries paid civilians and that the witch-hunt practices deter some from entering or staying in Government service. I also want to condemn the practice of pulling competent civilian scientists and engineers out of Government and especially military laboratories, and drafting them for purely military service where scientific competence is only slightly, if at all, used. Our scientists should serve where their efforts can best serve the country's interests.

Lastly, I would comment unfavorably on the practice of rotation of military personnel, which is applied to scientists in uniform as well as others. Many of our scientists in uniform (usually officers) are transferred from important projects at military research centers or in staff jobs at the Pentagon, just because the calendar indicates that it is time to move (in the Navy, after 2 years; in the Army, after 3, I believe). Research and development suffers seriously from changes in personnel. Continuity of effort over a period of years by a team of scientists is of great importance to the successful culmination of a project.

As regards discussing the problem with one of your staff, I would be happy to do so if you so desire. I am not planning on being in Washington until the 25th of June when I could make myself available between 9 and 10 a. m. or late in the afternoon. This date would probably be too late to be of interest to you. Should you wish to have me testify, I will respond to the call, but I am not soliciting the opportunity.

Very truly yours,

N. A. SHEPARD, *Chemical Director.*

INDIAN HEAD, MD., *July 16, 1954.*

HON. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Committee on Government Operations,
House of Representatives, Washington, D. C.

DEAR REPRESENTATIVE RIEHLMAN: Thank you for an opportunity to express my thoughts on the problems of our military research and development program today, as requested by your letter of July 8, 1954.

My experience in Government laboratories extends over a period of 12 years. After completing my requirements for the doctorate degree in June of 1942, which was made financially possible by a NDRC fellowship, I accepted a position as physical chemist with the Department of Chemical Engineering of the Ten-

nessee Valley Authority, Wilson Dam. My decision to accept this position was based on my conviction at that time that the greatest opportunity for high-caliber research was available in Government laboratories. Only a very few industrial laboratories then appeared to understand that in order to flourish, scientific endeavor required a "research atmosphere." I will attempt to define "research atmosphere" in a subsequent paragraph. During my 4 years of association with the TVA group, I found complete satisfaction as a scientist. My former professor, in April of 1946, persuaded me to join him at the Naval Ordnance Test Station, Inyokern, Calif., when he had accepted the task, after more than 20 years of academic life, of helping to organize a research department. My initial contact with Government research within the military structure, therefore, began in July of 1946. I remained at Naval Ordnance Test Station until August of 1951 when I accepted the position of Associate Director of the Research and Development Department at the Naval Powder Factory. During January of 1953 I assumed the directorship of this Department, and I am currently occupying this position. The Department is concerned with phases of research and development of propellants as applied to guns, guided missiles, catapults, and rockets as directed by the Bureau of Ordnance, Navy Department.

During the 9 years of my personal association with research and development within the Navy Department, I believe that I have observed progressively increasing difficulty in retaining qualified scientists and in inducing qualified scientific personnel to join this vital effort. This condition has been generated by many factors and has resulted in placing Defense Department laboratories in an unfavorable competitive position with respect to industrial laboratories.

Perhaps an analysis of the conditions necessary to permit the scientist to function efficiently (previously referred to as research atmosphere) and the comparison of these conditions with those in existence within the Defense Department today will define most clearly these factors. The scientist, in my opinion, desires in addition to adequate compensation, an opportunity to meet the challenge of nature by application of scientific methods. He requires that his superiors be able to recognize his ability to do so. He desires to be able to communicate his achievements through the media of participation in professional meetings and through scientific publications whenever possible in the open literature. This research atmosphere, typically available to the research scientists at one time only in universities and Government laboratories, now is available in many industrial laboratories as well, and is supplemented by such additional advantages as:

(*a*) Higher salaries than can be offered under current civil-service regulations. The initial salaries in defense laboratories for junior scientists is on the average about $100 a month less than for comparable industrial positions. For senior scientists the differential is even greater, amounting in many cases to $10,000 a year less than the industrial salary.

(*b*) Opportunities for advanced training are being offered by many industrial laboratories at no expense to the scientist. Defense laboratories are restricted by regulations from providing this inducement.

(*c*) Key scientific personnel in industrial laboratories receive from double to triple the remuneration of comparable personnel in Government. The obvious result has been the loss of our most valuable and irreplaceable personnel continually from Defense to industrial laboratories.

(*d*) Leave available to Government scientists with less than 15 years' service is now comparable to that offered by industry and therefore no longer represents a inducement.

(*e*) Participation in professional societies is encouraged by successful industrial laboratories even to the extent of allowance for payment of dues. (I personally feel that a professional man should assume his own professional expenses.) Recent Government restriction on travel to, and attendance at, professional meetings have materially affected the morale of Defense Department scientists.

(*f*) Industry provides liberal expense accounts for personnel in travel status, whereas Government employees usually suffer financial loss because of limited per diem allowances.

(*g*) Industrial practice permits the recognition of outstanding ability by increased salary without an increase in equivalent administrative responsibility. This type of recognition is difficult to effect under the current policy of interpretation and implementation of the Classification Act.

(*h*) Stable "one package" budgets for research and development practiced by many companies assures continuity of effort. The "multi-package task assignment" system used by the Bureau of Ordnance based on yearly allotments of funds introduces the element of uncertainty.

In addition to the indicated unfavorable competitive position of the Defense Department laboratories, the relationship between military and scientific personnel introduce difficulties. The scientist is trained to be objectively critical of his own efforts and the efforts of his colleagues. This attitude is different from that of the military officer whose training and experience has been to accept orders from superiors without question. There is ample justification for each type of training in the respective fields. Therefore, the scientists should be charged with the responsibility for research and development and supplied with the necessary authority to efficiently discharge this responsibility; the military should be charged with the responsibility of delineating the problem, with the supplying of all pertinent information and with the authority to accept or reject, as the user, the results of the research and development effort.

The British, as you know, after the last war attempted to solve the problem of the relationship between scientific and military personnel by reassigning the responsibility for defense research and development from the Ministry of Defense to the Ministry of Supply. The military, therefore, has been placed in a position of "buying" research and development. The defects of this system appear to be ascribable to the lack of close association of the "user" and "supplier" and to a separation of responsibility for the single objective of developing an adequate defense. For these reasons, I feel that the extensive use of contractual arrangements for military research and development also would be undesirable. The Canadian Government has established a fourth department for research and development administered by civilian scientists within the Department of Defense. My impression is that the latter system operates satisfactorily in Canada and may merit consideration by your committee.

Kindly permit me to express my appreciation for an opportunity to present my views regarding these vital problems. I trust my thought may prove of some value to your committee.

Very sincerely yours,

SOL SKOLNIK,
Director, Research and Development,
United States Naval Powder Factory.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
DEPARTMENT OF AERONAUTICAL ENGINEERING,
Cambridge, Mass., June 9, 1954.

HON. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Congress of the United States, Washington, D. C.

DEAR SIR: Your letter of May 26 outlined several key questions concerned with the operation of various scientific research and development programs in the Department of Defense and asked for my views concerning them. While I am not highly qualified in the field of governmental administration of scientific research, I do have some comments on these questions which I am summarizing here. If your subcommittee staff would like to discuss these views with me, I would be glad to meet with them at any time here in Cambridge, or in Washington at the end of next week when I am planning to attend a Department of Defense meeting on June 18 and 19 at the Pentagon.

One of your questions concerns the desirability of the establishment of a civilian organization to administer military research and development programs. For two of its services, the army and air force, Great Britain has such a system with which I became familiar during World War II as a scientific liaison officer at the London Mission of OSRD. Comparing the operation of their system and ours and trying to find a clearcut advantage of such a civilian organization in this country, I can find none. There are advantages and disadvantages to each system. Without going into details of all of them, I might mention that the British system sometimes placed complete responsibility for certain research and development projects to be carried by committees made up of members of several independent agencies, some on the military side, some on the civilian side. This is a serious disadvantage in my mind, for I believe committees, while they can coordinate, advise, and explore on paper, cannot effectively be responsible for the day-to-day operations of a research and development project. Such a project is more effectively the responsibility of a single organization with a single line of authority. While this is only one of many pros and cons, on balance, I am not in favor of a separate civilian agency.

You raised the question of the existence of "any characteristics inherent in military organization which are incompatible with the administration of an effective program of scientific research and development." While the present system has much room for improvement, it is today an effective system. Since World War II much progress has been made toward the creation of this effective system. For examples, while funding is still on an annual basis, in program planning it has been recognized that research and development projects are almost always of longer duration; civilian advisory committees have found more important places; close relations have been established between private industry and nonprofit institutions on the one hand and the military on the other.

Another question bore on the subject of the tendency "to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified scientific and technical personnel." Considering just the service laboratories themselves, I think there is no question that the presence of two distinct and different groups, the scientific and the military, within one laboratory, with the final authority vested in the military, creates a situation considerably less attractive to civilian scientists or engineers both from the standpoint of hiring and retaining scientists and of getting the best work from them. Military men and scientists differ in personal goals and working habits; the rewards each are seeking are different. The most effective laboratories within the services are those with the least military dominance not only in matters of policy, programs, facilities, etc., but in services such as transportation and housing. I believe, and this answers in part another of your questions, that research and development should be performed by civilian-run laboratories and that military support activities should be separated from them.

Your last question concerns the extent of participation of private industry and private nonprofit institutions in military research and development. I believe that the best work will always come from these two sources. The "in-house" research performed should, in general, be held only to a level to enable the military to exercise qualitative control over research and development. There are certain exceptions here where large facilities such as wind tunnels, proving grounds, etc., are not normally available outside of Government establishments.

Let me say in closing that I am pleased to see this effort on the part of Congress to improve scientific research and development in the military organization.

Sincerely yours,

H. GUYFORD STEVER,
Associate Professor.

UNIVERSITY OF MICHIGAN,
SCHOOL OF GRADUATE STUDIES,
Ann Arbor, July 27, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Committee on Government Operations,
Washington, D. C.

DEAR SIR: In reply to your letter of July 8 I wish to give you the following comments on the military research and development program. In this connection I should like to give you my background in this field. During the war I served as commander, United States Naval Reserve, in charge of laboratories at the United States Navy Proving Ground at Dahlgren, Va. In 1946 I was technical director of Operation Crossroads, which conducted the atomic tests at Bikini. Since 1946 I have served on the following committees: Special Committee of the Scientific Advisory Committee of the Air Force, to report on the research and development program of the Air Force; National Research Council Committee on Amphibious Operations; Scientific Advisory Board of the Naval Ordnance Test Station, Inyokern, Calif.; Scientific Advisory Board of the United States Navy Proving Ground, Dahlgren, Va.; Advisory Committee for Physics for the National Bureau of Standards; group leader of project Wolverine, summer of 1953, to study battle fields surveillance problems; Scientific Advisory Board of the Naval Ordnance Laboratory, White Oak, Md.

My contacts with the program, then, have been largely with the working organizations and laboratories. I have not had much contact with the operations of the Research and Development Board nor with those of the Office of the Assistant Secretary of Defense, which succeeded the Research and Development Board. My impression is that these organizations have been earnest, sincere, and hard

working, but they have never fully mastered the immense problem of coordinating the whole program, and of eliminating interservice duplications and rivalries. However, on this point you most certainly have testimony from people who have been closer to these programs.

The research and development program of the defense organization has been carried out in the following ways:

1. Direct contract to industry.
2. Direct contract to universities.
3. Independent laboratories operated by contract with industry, such as the Sandia Laboratory operated by the Bell Telephone Co.
4. Independent laboratories operated by contract with universities, such as the Los Alamos Laboratory of the Atomic Energy Commission.
5. Research carried on with transfer funds by nonmilitary civil-service laboratories.
6. Laboratories operated by the military agencies.

Each one of these procedures seems to have its desirable points and I believe that each one has its place in the research development program. In each there have been conspicuous successes, and in each, I am sure, some failures. A few comments on each type of operation follow:

1. Research and development by direct contract to industry has many advantages, particularly for the development engineering and production phases of new and specialized equipment. Conspicuous successes have been, of course, the work done in the laboratories of the Bell Telephone Co. The weakness of this method is that contracts are usually at cost plus a fixed profit, and that the research does not contribute directly to the commercial production of the companies. They tend, then, not to put their best men and their best efforts on this type of research.

2. Research and development done by direct contract to universities is particularly advantageous for basic and foundational research and for studies in entirely new systems and procedures. The universities are well equipped with high-level research scientists who are skilled in this kind of work and who are willing even in peacetime to devote a certain amount of their time and effort to it.

3 and 4. Independent laboratories administered by industry have many advantages. This sort of laboratory does not compete so directly for men and services with the other work in commercial laboratories of the industry and it is not subject to many of the limiting restrictions of civil-service employment. The same can be said for independent laboratories administered by universities. In many cases both of these two types of laboratories have been very successful because of the relative independence and freedom of action and expenditure that they enjoy.

5. Research carried on in the civil-service nonmilitary laboratories by transferred funds, in my opinion, has not been so successful, generally. Because of the higher compensation usually paid to the scientists in the military projects by means of rapid promotions and other advantages it has interfered with the regular work of the laboratories and has sometimes had a disrupting effect.

6. I should like to speak especially of the Defense Department civil-service laboratories, such as the naval ordnance test station, the Army arsenals, Fort Monmouth, and others. It seems to me that these laboratories are the backbone of the defense effort. They undertake problems in which industries and universities are often not much interested, they maintain a close liaison with the Defense Departments, and they are absolutely vital in peacetime and wartime as a backlog of experienced personnel continuously engaged in military research. These laboratories, however, suffer from very serious handicaps. In the first place, they have military administration. The problem of cooperation between the military and the civilian scientists, while essential to the best development of weapons, has not been completely worked out in these laboratories. The Navy, in its naval ordnance laboratory and naval ordnance test station, has probably the most successful experience. Serious problems, however, still remain and I recommend that you talk with people who have had direct experience in their administration, such as Dr. Ralph D. Bennett of the naval ordnance laboratory, and Dr. L. T. E. Thompson, now of the Norden Instrument Co. on Long Island, who was for a number of years technical director of the naval ordnance test station. In the second place, these laboratories suffer from the fact that they are under civil-service administration, and civil-service procedures for scientists are still quite unsatisfactory. In this connection you may be familiar with a sampling of the opinion of scientists made for the President's Scientific Research Board which showed that a Government career for a scientists ranked a very poor third

to careers in universities and industrial laboratories. And of Government laboratories, I am sure, that careers in the laboratories of the Armed Forces would be ranked well below careers in other Government laboratories. The difficulties here largely arise from the mechanical application to scientists of the civil-service system. The obstacles are those such as inappropriate recruiting procedures which do not permit direct recruiting and examining by the operating agencies or even by boards including scientists, mechanical policies of promotion, inadequate opportunities for scientific contacts, for attendance at scientific meetings, and for publication.

These have been discussed in the report to the President's Scientific Research Board by the Interdepartmental Advisory Committee on Scientific Personnel, with which you are no doubt familiar.

In the last few years the situation with regard to civil-service Government employment seems to have gotten worse rather than better. Such actions as limitation on vacations and sick leave, more restrictive and, to scientists, often incomprehensible security procedures, new restrictions on travel, attendance at meetings and use of telephone, and the unfortunate experiences of some scientists before security boards and congressional committees, have all tended to make Government service, and particularly service in military laboratories, seem less desirable.

Your committee could do a real and great service to the military research and development program by initiating steps which would make a career in these laboratories more attractive to scientists. These steps must be such as to put work in these laboratories at least on a par with work in industrial laboratories, in pay rates, promotion procedures, contacts with other scientists and security, and reasonable security clearance and classification procedures. These steps will require some liberalization of civil-service procedure and a realization that mechanical civil-service methods cannot be applied to scientists in the same way that they are to stenographers, machinists, or even nontechnical department employees.

Sincerely yours,

RALPH A. SAWYER, *Dean.*

HAMILTON, N. Y., *July 13, 1954.*

Hon. R. WALTER RIEHLMAN,
House Office Building, Washington, D. C.

MY DEAR CONGRESSMAN RIEHLMAN: Your letter of July 8, 1954, has just been received and I am very appreciative of the opportunity you have given me of making a statement regarding "important problems confronting our military research and development program today."

(1) Civilian scientists must work in close harmony with practical military men. To accomplish this is difficult but not impossible; "The Navy's missile development station and proving ground at Inyokern and other Government laboratories have demonstrated the brilliant success possible" (Baldwin, New York Times, July 1, 1954). Mr. Baldwin describes a situation which existed at Inyokern in 1948–51, but which has deteriorated since that period.

(2) Administration of research and development activities by military commanders is very dangerous. In fact it is just as impossible to have research and development controlled and directed effectively by military administrators as it is to have effective military effort result if you place a skilled research administrator in charge of an army in battle. Much of the research and development effort of the Air Force, Army, and to a lesser degree of the Navy is administered directly by military commanders who are shifted frequently and periodically. I feel that at present there is a marked tendency toward more direct military control in research and development within the Navy organizations.

(3) Unified control of all research and development activities can be more effectively brought about. This is a problem that the new administration has been giving much attention to. Some of us would like to see all defense research and development under a separate service of the Department of Defense and divorced as far as management is concerned entirely from the Army, Navy, and Air Force. Such a move would create a whole new set of problems and would present many difficulties. This is, I understand the Canadian system. Your subcommittee might well investigate the feasibility of such an organizational change.

(4) A proper balance of effort between fundamental or semiprogramed research (long range) on the one hand, and applied research and development (that concerned with immediate problems) must be maintained by the research adminis-

trators. The continuing successful defense effort in the field of research and development requires that the former area is not neglected in the interest of crash programs.

(5) The most serious immediate problems confronting the research and development program of the Defense Establishment are the result of poor morale of scientists in Government establishments. The defense laboratories are losing many of their ablest scientist and research administrators who are all too often replaced by persons of lesser ability. I know from personal experience that it is becoming increasingly difficult to recruit new personnel at all levels and it is especially difficult to recruit at the intermediate and high administrative levels. This is a valid and realistic statement based on observation. It is most certainly resulting in long range lowering of standards and accomplishments of the defense effort in the area of research and development.

The statements I have made may very well sound dogmatic but the dogmatism is mostly the result of brevity. To recapitulate, I believe that the most important problems, from the standpoint of operations, confronting our military research and development program, lie in the following areas: (1) Deterioration of cooperation between military specialists and civilian scientists, (2) dangers from direct direction and control by military commanders, (3) lack of unity of control at the level of the Department of Defense, (4) proper balance of foundational and semiprogramed research and applied research and development, and (5) poor morale of scientists in Government establishments.

Permit me to express again my thanks for the opportunity to express briefly my views regarding these most important problems.

Very sincerely yours,

GILBERT B. L. SMITH.

WHITE SANDS PROVING GROUND, N. MEX., *July 16 1954.*

HON. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
House Office Building, Washington, D. C.

DEAR SIR: In reply to your letter of July 8, 1954, this is to advise you that I have prepared, and am enclosing, a statement of what I consider to be the most important basic problem confronting our military research and development program. Since you requested a brief statement, and because of the many complexities, I have not undertaken to suggest any action leading to solution or alleviation of this problem.

I am certain that you will recognize that the enclosed statement represents entirely my personal opinion, is not submitted in my official capacity, and does not at all necessarily have any connection with official opinion of the Navy Department.

If the enclosed statement is in any small way helpful to the Military Operations subcommittee, I am most happy to have served.

Sincerely yours,

LEVERING SMITH,
Captain U. S. Navy.

The most serious and most basic problem confronting our military research and development program has to do with the broad planning and technical direction.

The planning is a phase which requires a great deal of technical competence, the use of the very best analytical techniques, and ability to understand strategic plans as well as to apply the information to conceived tactical situations. It is a phase which must be sufficiently under military control to give a reasonable probability that the end products are suitable for combat use and in the main it must be conducted by Government employees. The nature of this phase is, I believe, quite well illustrated by the article Bell Lab's 230 Long-Range Planners in the May 1954 issue of Fortune magazine. At the present time little success is being achieved either in getting adequate effort or sufficiently well-trained personnel devoted to this phase. The value of such thorough planning is much more difficult to assess in the case of military research and development than in the case of industrial research primarily because of the lack of comparative yardsticks, except in case of war, and secondarily because of the greater complexity imposed by long lines of communication. Also, many of us tend to believe that we can do as well using our superior judgment and, when pressed for time, are discouraged by the considerable time required to make thorough studies. We

are also discouraged because the results of studies can so easily be upset by new facts and because it is so very difficult to check the studies for errors and lack of complete objectivity.

In my opinion the various complexities and hindrances can only be overcome by attracting first-rate technical personnel to these planning tasks. These people, in addition to having high technical competence, must also be intellectually honest, have undivided loyalty, and be willing for others to carry out the resulting development without detailed direction. This is a large order and there are many obstacles standing in the way of attracting such persons; however, the basic requirements are that they have real respect for the competence of their superiors, that they have a conviction that their work is resulting in real improvements in the national welfare, that there are a minimum of petty annoyances in performing their work, and that they are not required to suffer unreasonable loss of income.

Another requirement for attracting the proper personnel, and for carrying out the work, is frequent and complete contact with the original sources of required information. In my opinion, this work cannot be carried out in a single location, even for a single service, nor at a single echelon of responsibility. All echelons have their part to contribute and to do an effective job each must thoroughly understand the studies of the higher group.

The problem of technical direction of programs and projects is very similar and closely related, to that of planning. There must be mutual respect between the director and developer based upon recognized competence and the developer must be given adequate freedom of action to permit him to make the maximum contribution within the plan as new information becomes available. To do this the developer must have rather complete understanding of the factors entering into the plan and have the ability to recognize the influence of new information on the plan. Further, the plan must be under almost continual review. The factors involved in attracting high-caliber personnel for this work are, I believe, practically the same as stated above.

I recognize that there are many ramifications of the above problems, that solutions can probably only be gradually approached, and that ideal solutions can probably never be reached; however, the alternatives involve risk that we will be second best when the results of our military research and development are put to competitive test; and, in the meantime, we will be putting heavy drains on the national economy by carrying to final development and service test items which could have been stopped with high assurance of having taken the correct action, at much less expensive earlier stages.

LEVERING SMITH.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
Cambridge, Mass., June 16, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
House of Representatives, Washington, D. C.

DEAR MR. RIEHLMAN: The questions formulated in your letter of May 27 go right to the heart of major difficulties experienced by all those who have dealt with the research and development program of the armed services in recent years. There is in my opinion no answer to any one of these questions that applies flatly at all times and in all situations. Before venturing to reply in detail let me make clear my general position.

First, I believe that the Department of Defense has a direct part to play through its own laboratories in the total research and development program of the country. Although the primary responsibility for the conduct of research and development rests with industry and with the universities, the armed services have also a role that cannot be wholly delegated to civilian agencies. Thus I support the concept of scientific laboratories under the direct supervision of the several branches of the Department of Defense, but urge that more attention be given to a proper definition of their objectives and the manner in which they conduct their operations.

Second, I have little faith in the existence of a unique, perfect organizational structure precisely designed for each particular task. The quality of men has more to do with success than the rules under which they work. Gifted leadership is more potent than the logic of organization. In skillful hands and with sympathetic and intelligent support from above, almost any pattern of organization can be made to function. Some forms, however, are more favorable to the selection and retention of first-class men than others, and it is this favorable climate for

research that we are seeking to establish. Thus I think it entirely possible that a military organization may provide effective administration of research, but I also consider it rather unlikely for reasons that I shall develop below.

Finally, I wish to point out that research and development are by no means one and the same thing, although it has become customary of late to lump them together. Both call for an education and experience in science, but the aims are different, the methods are different, and there are in fact characteristic differences of interest and manner of thinking on the part of those who engage in these activities. It appears to me that a failure to define clearly the function and objectives of our Government laboratories has been the source of much confusion and misunderstanding. To make matters worse, there are groups that must add the procurement of research and development to their ambiguous responsibilities for the conduct of these activities in their own laboratories. A plan of organization and a selection of staff well-fitted for one function is likely to be wholly unadapted for the other. There is an urgent need to limit and define specific objectives of the multitude of laboratories under military direction, as a prelude to any change in organizational structure.

You inquire first in your letter whether there are any characteristics inherent in military organizations which are incompatible with the administration of an effective program of scientific research and development, and second, whether the military organization of a research and development program tends to create conditions which retard the work of scientists or make it difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel.

Here it is important to specify whether we are discussing primarily scientific research, or engineering development, or the procurement of research and development through other agencies. Scientific research of any worth is a highly individualized activity. Although men may appear from time to time whose gifts of leadership in science are such that they overcome all material obstacles, I do not think that anyone would contend that military organization is conducive to a favorable environment for research.

In fact, the problems that have led to the traditional military concepts of organization are the very antithesis of those that affect the conduct of research. Although it is increasingly true that teamwork plays an important role in large-scale research and development enterprises, all real achievement is measured by the creative originality of individuals and it is the sole function of scientific organization and leadership to maximize these individual contributions. An army, on the other hand, is designed to absorb the human material that flows into its ranks and to weld that material into an effective unit to accomplish certain simple and well-defined objectives. By force of necessity the system must be largely impersonal; it must function moderately well independently of the personalities of those who occupy particular positions of command. Channels of command and response must be clearly defined. Men move from one assignment to another, remain for a period of duty, and then pass on to another post. From all this there results that emphasis upon the structure of organization and procedure which governs military thinking to a considerable degree, and perhaps also an excessive confidence in the effectiveness of reorganization as a cure for almost any functional ill. This is an attitude generated by years of experience with practical situations involving large numbers of men under conditions of combat where free play to the imagination of a soldier or subordinate might well result in disaster to the larger unit.

I do not in the least imply censure of military organization in these remarks. It is admirably adapted to the impersonal control of large bodies of men under field conditions. It is bulwarked by massive codes of rules and regulations. But its basic philosophy is starkly opposed to that of the laboratory where progress is represented only by departures from conventional thought. Civilians inevitably chafe under such a system and the problem of retaining qualified personnel is made vastly more difficult.

In sum then, there are in my opinion characteristics inherent in military organizations incompatible with scientific research, and the military organization of research tends to create conditions which make the task of building and holding a first-class staff insuperably difficult.

Questions 3 and 4 are closely related, but are particularly difficult to answer because here again research shades into development and then into field test and evaluation. The organizational problems at one end of this spectrum are totally different than those at the other.

First I submit that there is a place under the auspices of the Department of Defense for a limited number of research laboratories of the highest quality,

devoted to the investigation of scientific problems directly related to the short-term interests of the armed services. I have come to the conclusion that these ought to be largely civilian organizations under civil service, and I think that this country must find means of developing its civil-service regulations to the point where such posts can be made truly attractive to eminent scientists.

To avoid any possible misunderstanding, let me emphasize that although it is my opinion that such research laboratories ought normally to be under civilian direction, I am distinctly opposed to the idea of a civilian agency outside the Military Establishment for the conduct of military research, nor would I support a plan for the centralization of research under a single agency in the Department of Defense itself. A direct and tangible tie between the activities of the laboratory and the interests of the Army, the Navy or the Air Force, as the case may be, is of the utmost importance. Otherwise all research had best be delegated to industry and the universities.

The current practice of maintaining duality of command—a military commander and a civilian technical director—in establishments whose primary interest is applied research appears to me to be unsound, and I think it should be abolished. Occasionally this arrangement has worked because of a fortunate matching of personalities. More often than not such harmony proves to be short lived. The civilian technical director is a permanent resident, and his professional interests coincide with the objectives of the laboratory. His superior, the military commander, is a transient doing a tour of duty in the management of a research establishment. Very likely he is an intelligent officer who grasps thoroughly the basic importance of research to the development of military technology, but professionally he is a military man and not a scientist and his professional rewards lie in fields other than science. Only in rare instances does he remain long enough in his post to master all the complexities of a large laboratory and the idiosyncracies of its scientific staff. Without this knowledge and experience real leadership and effective management are impossible.

Again let me emphasize that these remarks are thus far confined to laboratories whose function is applied research, as distinct from engineering. It does not seem to me appropriate that laboratories under direct military supervision should engage in any extensive program of basic research, but inevitably some research of this nature will be carried on if the staff is really first class, and should not be discouraged so long as it remains within bounds. Under the general heading of applied research one might cite a vast array of problems in the fields of fluid flow, metallurgy, corrosion, the chemistry of ordnance, communications theory, electromagnetic radiation and propagation, and so on almost without limit, that have a bearing upon military weapons and operations, and yet are not directly related to the design of a particular device. Such programs of applied research should be intimately related to the interests and needs of the using branch, but I have seen no evidence that this bond can be achieved by the simple expedient of making a professional military man the nominal head of every laboratory, nor am I convinced that this arrangement is the essential means of obtaining the necessary supporting services. The task of obtaining outstanding scientific leadership will be notably easier if the goals of the laboratory are clearly defined and the director entrusted with full authority and responsibility.

At the risk of belaboring a point, let me emphasize that the distinction that I draw between the soldiers and the civilians has nothing to do with intelligence or competence in their respective professional fields. It is simply that their aims and interests are different. A man who chooses a military career is normally of a decisive temperament with a liking for action and an ambition to exercise leadership through command over men. These qualities are accentuated by military training and if they are lacking to any large degree it is unlikely that he will prove to be an effective officer.

If however the normal temperament of military men is ill-adapted to the conduct and direction of research, there is nevertheless a most urgent need for officers in responsible positions to understand the character of research and development, its methods, its limitations and potentialities. The products of research are not to be bought over the counter. They require knowledge and understanding on the part of the consumer, and this knowledge and understanding can be acquired only through education gained by some degree of participation in the actual conduct of research and development. All military laboratories ought to contribute to this process of education. Although the direction should normally be in the hands of civilians who are professionals in research, the assignment of officers to the staff for periods of duty following adequate technical preparation in universities is highly desirable. Thus the process of education is extended

and an effective bond established between those who must generate new technology and those who are to apply it.

Passing now from this discussion of applied research to development, testing and evaluation, we discover that the problem becomes more complex. There must be no gulf to bridge between the activities of the laboratory and the user in the field. The interchange of views on needs and capabilities must be intimate and constant. This is peculiarly true of all military laboratories engaged in development, because engineering of a more general character, or directed toward production, ought largely to be delegated by contract to industry. The conduct of a laboratory for the development of military devices calls for an extensive understanding of military problems, and in most instances there is a need for supporting services far beyond that normally required by research programs. Consequently an excellent case can be made for military supervision of such establishments. Unfortunately this does not completely resolve our organizational problem, since much of the work will be done by civilian engineers and a civilian technical director may be essential. Nevertheless I suspect that the difficulty of reconciling differences in attitude and points of view will be milder than in establishments devoted wholly to scientific research.

Turning finally to some of the points implied by your question 5, it has been my view that by far the largest portion of the total military research and development program ought to be placed in the hands of private industry. It is in industry that are to be found our principal resources of technically trained men and laboratory facilities. I suspect that the Department of Defense can go even farther than it has in the past in the way of contracting with private industry for installation and maintenance services as well as for the development of new equipment. Just where the line is to be drawn between the functions and responsibility of industry and those of the armed services themselves is difficult to say and will depend upon the particular circumstances. I am proposing in general that the Military Establishment conduct a moderate amount of research and development as a necessary means of keeping in intimate touch with the advances in science and technology. Although it may not be rational to anticipate important contributions to these advances from our military laboratories, we must count principally upon professional military agencies to call to our attention potential applications of new technology to the problems of warfare. Private industry, then, offers vast supporting resources to be drawn upon as widely and fully as possible.

May I, in conclusion, express briefly a few personal views on the relation of universities to the defense program.

The purposes of a university are teaching and the advancement of knowledge. These functions are not normally compatible with the conduct of classified research and development programs. Large programs of defense research may readily endanger the financial stability of a university and divert the attention of the most gifted members of its staff from interests that in the long term might result in richer contributions to the welfare of the country.

Unhappily, a policy appropriate for times of peace may be impractical under the conditions of stress which we presently experience. Our universities afford vast resources for research. Some of these, particularly in the case of the larger technical institutions, are unique in the quality of their facilities and staff. As a matter of practical common sense, the Government in periods of emergency must call upon such institutions for national service, and they in turn must accept public responsibilities that overshadow their local, institutional interests.

I believe that the practice of placing large, classified defense projects with universities should be subject to constant review and questioning, and that it should be severely limited to projects of the utmost urgency wherein it can be clearly demonstrated that comparable facilities will not otherwise be available.

Having expressed the opinion that large defense projects can be harmful to a university, I must in all honesty add my conviction that universities are capable of very great contributions to the total defense effort. There is a view frequently expressed by members of our industrial community that university projects do no more than compete and duplicate that which is better done in industrial organizations. I do not believe that this is necessarily true. Technological progress is in the main like the building of a reef of coral—pushed slowly forward by small incremental change. It is well from time to time to hasten the process by the injection of ideas that stir the imagination, that both provoke and stimulate. If the university has any role to serve, it is to help us to break out of conventional processes of thought. No university laboratory staff has the practical experience in engineering design and operation that is the common ground of

industry, and it is idle to look for it there. But in partnership with Government and industry the university has a fertile part to play as innovator and catalyst.

The foregoing statement is far from being either a complete or comprehensive analysis of the questions presented in your letter. I do hope that it indicates satisfactorily the general tenor of my thoughts on these matters, and I shall be happy to elaborate to any degree that you may desire.

Sincerely yours,

J. A. STRATTON,
Vice President and Provost.

BARTOL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE,
Swarthmore, Pa., June 1, 1954.

HON. R. WALTER RIEHLMAN,
House of Representatives,
Military Operations Subcommittee of the
Committee on Government Operations,
Washington, D. C.

MY DEAR MR. RIEHLMAN: I have your letter of May 27 and will endeavor to reply to it in such fashion as to deal with the general topics which you have listed. Perhaps it will be well, however, if I commence with one or two general statements which may serve as a background to the more specific answers to the questions which you raise.

GENERAL STATEMENT

Prior to the First World War scientific research, particularly in the physical sciences, depended primarily upon Europeans. The custom was for young potential scientists to seek their training in European countries—particularly Germany, England, and France. It was natural, therefore, that there should exist a feeling of dependence in which American science sought the leadership of European science. With one or two brilliant exceptions, there were few American investigators of worldwide eminence, and when some new venture was undertaken, it was quite customary to look to Europe for someone to take the initiative in mapping the course of such a venture and directing its progress. Thus, American institutions incorporated many European scholars into their ranks and these scholars played a large part in the development of the future.

The war brought into existence the National Research Council, and mainly through the fellowships which it offered, America, in the intervening period, has built up a strength of research personnel second to none. We have only to look at the list of those now prominent in research to see how this has worked. To cite two instances: E. O. Lawrence, Nobel Prize winner and the inventor of the cyclotron, is a national research fellow. J. R. Oppenheimer is a national research fellow. Indeed, if one looks over the various American research institutions of the present day, we find them in very large part under the guidance of those who owe their training and development in science to the opportunities afforded by the National Research Council.

During the period between the two world wars American physics came to stand more and more upon its own feet and to rely less and less upon Europe for ideas and inspiration. By the time the Second World War came upon us, the country was ready to organize atacks upon its various scientific problems through the utilization of its own personnel. It is quite true that it was in the developmental aspects of science that American physicists showed the greatest strength and that it was still European physicists of an earlier generation whom we had to thank for some of the fundamentals in discovery upon which the developmental program was based. This is particularly so in the matter of those achievements which led up to the realization of the atomic bomb.

During the war, scientific and military personnel learned to work together and to understand the need for differences in approach to their very different problems.

After the Second World War, the Government felt the necessity of fostering the development of the fruits whose seeds had now been sown. and it wisely set up certain organizations to this end. The purposes of these organizations covered a wide field. By their nature, they were of various kinds and operated in different ways. Some were concerned with classified material and some were unrestricted.

One of the most farseeing aspects of this postwar development was a recognition of the importance of continuing and extending fundamental research, so that in the future the country would have its own seeds of progress to plant and would not have to rely, as in the past, upon European initiative. The activities of the Bartol Research Foundation have been concerned primarily with the Office of

Naval Research which, in the beginning at any rate, was perhaps more prominent than any other organization in fostering fundamental investigations. Fortunately the personnel of the Office of Naval Research managed to set up a continuous chain of understanding between the purely military personnel and the purely scientific, so that the latter were able to work with the freedom to which they were accustomed and which is, indeed, necessary for work of this kind. Our own relations with the Office of Naval Research have been most cordial, satisfactory, and, we believe, efficient, and we are convinced that the Office of Naval Research has played a very fundamental role in the enormous development in scientific activities which have taken place in America since the end of World War II.

While our work has, for the most part, been in the nonrestricted category, the understanding has been that when any researches seemed to be developing to a point where secrecy measures should be adopted we would advise the Office of Naval Research to that effect. However, we have been hampered by no irritating controls in these matters, and the result has been to produce a spirit in which the strongest disciplinary influence in matters of security and conscientious effort—an influence outweighing all more legally voiced restrictions and controls—is the determination that no action shall be taken which will in any way tend to let the Office of Naval Research down in the support which it is giving to the work.

Naturally, there is a tendency, when public money is being spent, to view with a critical eye procedures which do not seem to strike immediately at the desired goal. During a war the end product is all-important, but even here, too much concentration on the end product, to the exclusion of the things which make the end product possible, may end in catastrophe. It is generally recognized by scientific people that the failure of Hitler to utilize to the full the undoubted strength of Germany's scientific potentialities resulted from curtailment of fundamental research at too early a stage in favor of the development of utilitarian devices. It is probably this fact which delayed Germany in producing an effective atomic bomb.

There are times when there may be a tendency for political philosophy to seek consolidation of effort and to unite the research activities, at present conducted by various agencies, under a single head. Superficially, this may seem the most efficient procedure, and yet, if there is one philosophy which the present Government favors above all others, it is surely the philosophy of private enterprise; and the working effectiveness of private enterprise resides in the healthful operation of the competitive instinct. We consider it a good thing to have many companies doing approximately the same thing in that they are making automobiles or refrigerators or furnaces, etc., because we believe that the free competition which ensues results in a better product and in a more rapid growth toward perfection. The competitive element is even more strong in scientific research, and if it does not constitute an inefficient procedure in industry, surely we cannot regard the procedure as inefficient in government-supported fundamental scientific research.

ANSWERS TO SPECIFIC QUESTIONS

Turning now to the specific points raised in your letter, I can perhaps answer them fairly briefly if my answers are interpreted in terms of the foregoing preamble. I will number my answers in the same manner as your questions.

1. There can be such characteristics, and undoubtedly there are. However, they are not, in my judgment, a necessary adjunct to successful research. The Office of Naval Research is an outstanding example of the most favorable conditions of operation from the investigator's standpoint. Many problems attacked in collaboration with the Air Force have shown very successful coordination of effort, as have problems with some of the arsenals. What is important is that the administration shall seek to understand that in scientific endeavor surety of achievement cannot always be guaranteed, and lack of achievement in any particular problem is not necessarily the fault of the investigator or indicative of bad judgement in attacking the problem. Success is to be measured in terms of the overall achievements of a group of problems, where it frequently happens that the outstanding success of one particular endeavor can outweight the failure of half a dozen others.

Again, while important progress toward success is sometimes attained in the lifetime, let us say, of a contract, the ultimate success may not be attained until years afterward. If one should measure success in terms of the achievements of any of the great pioneers of science and if he should measure it in terms of the day-by-day output of achievement, the comparison would probably present a

very depressing picture, so that even the question of continuing the employment of a Newton after his first year of work might become debatable.

2. The answer to this depends upon the circumstances. Where the nature of the work is such that security conditions are very rigid, one is apt to find quite a number of people who desire to avoid investigation of their affairs, in spite of the fact that they may be perfectly loyal in the practical sense. I think the evidence for this condition is perfectly plain. A great many people undoubtedly have things in their lives which they would not like to have publicly exposed—things which had no connection whatever with their loyalty but which might become bandied about as part of an overall investigation. Of course, the present Oppenheimer situation affords an example of many such things.

Another less vital matter concerns the routines of procedure necessitated by operation under Government auspices. The scientist of old did very little in the way of organizing his financial affairs. Today, when the scientist is presented with a situation in which all sorts of different expenditures are cataloged in different ways, and when he has, in these matters, a vague sense of responsibility whose limits are ill-defined, he is apt either to become confused in his activities or, what is worse, to gravitate from the realm of an investigator to that of an executive, and sometimes a very poor one. Once this starts, the man of science becomes lost to the purposes for which he was originally chosen, and unfortunately there is a tendency for him to take a certain amount of pride in his activities and satisfy his conscience for lack of further production by an appeal to the fact that no longer has he time for scientific work.

3. I do not think that this is necessary, provided that the conditions as cited under 1 are met. However, I see no disadvantage in it, provided that the civilian organization chosen is absolutely free from politics, is widely representative, and is constructed with the avoidance of all cliques within itself.

4. The answer to the first portion of this question varies with the nature of the activity. I think it would be very difficult to make a separation in the case of researches having to do with nuclear fission or thermonuclear weapons. Of course, that some separation is possible is evidenced by the fact that a good deal of the work in these fields is unclassified and concerns fundamentals. However, a complete separation would, I believe, be impracticable.

With regard to the second portion of 4, I do not think that the research and development work need be under the supervision of the military commander in the case cited. I do think, however, that it is a good policy of the scientific personnel to try to interpret to the military organization the meaning of what they are doing. If the proper relationships are established in this manner, it is my experience that the military personnel are willing to go a long way in avoiding the kind of control which would be obnoxious and can even be incited to enthusiasm in the work. The great thing is that they should not be left in the nervous condition of being technically responsible for something with whose progress they are unacquainted.

5. This question has several facets. I think the Department of Defense should contract with non-Government institutions to carry on military research and development programs. Such institutions are already set up and operate on the basis of long experience. Moreover, their internal management, founded as it is upon the necessity of making ends meet, but not so subject to governmental investigations at every point, are apt to be able to operate with a greater overall efficiency than is the case with a Government agency.

With regard to the participation of private, nonprofit institutions, I feel that the situation is the same as that for the other nongovernmental institutions already referred to. In fact, I think such private, nonprofit institutions represent some of the most efficient agencies for furtherance of research of value to the Government.

With regard to the participation of private industry, here again certain participation is, I think, desirable, although one cannot generalize in this matter. Some projects are more suitable for private industry, others are more suitable for nonprofit institutions. There is something to be said for bringing private industry very firmly into the realm of research activities. Some of our great industrial concerns, like the General Electric Co., the Western Electric Co., etc., have learned to appreciate the significance of fundamental research and to support it, even though the return is not immediate. They have learned to understand this situation—they have learned it through the happy circumstance that sometimes one major achievement in the scientific laboratory will produce a sufficient ultimate return to support the laboratory for all future time in idleness if necessary, and yet pay a good dividend to the company. It is not so easy for small

concerns to be so broadminded. The very fact of their smallness increases the fear of expenditure in which every dollar does not face its immediate return. The spreading of research over industry would tend toward a good educational influence and might point the way to some kind of overall insurance of ultimate return in the case of groups of small companies.

With regard to the last question concerning "in-house" research, I believe that such research is valuable. In the first place, if done independently, it exerts a control over the process of getting into a rut. Indeed, one of the great advantages of a certain amount of duplication of effort is to be found in seeking safeguards against an individual or group of individuals getting into a rut in which they labor continually along some path with no very clear reason to hope for ultimate success. They work hard and their consciences are justifiably satisfied. Frequently, however, a competitive spark from the outside can serve as a potent influence to give new life to the stream which would otherwise become stagnant.

In conclusion, I shall be very happy to appear before your subcommittee to answer any specific questions in relation to these matters, or to come down to Washington to confer with one of your staff members, if this seems more desirable.

I have to leave for Europe on a scientific mission early in July, so that it would be desirable that I should be of whatever service I can before that date. Incidentally, it would give us great pleasure to have a visit from any representatives you might designate to our laboratories in Swarthmore, when the opportunity would be afforded of illustrating some of the points concerned by actual appeal to the researches under way.

Sincerely yours,

W. F. G. SWANN, *Director.*

RUBBERSET CO.,
PLASTIC PRODUCTS DIVISION,
Salisbury, Md., July 21, 1954.

Hon. R. WALTER RIELMAN,
Chairman, Military Operations Subcommittee,
House Office Building, Washington, D. C.

MY DEAR MR. RIEHLMAN: Dr. Lawrence L. Layton recently forwarded to me your letter of July 8 addressed to him and inviting him to comment on the scientific research development programs for the Department of Defense. Since Dr. Layton knew of my own sincere concern about these problems, he has suggested that I forward to you comments similar to those which you requested from him.

I regret that the imminent adjournment of Congress has not permitted me to give the time I should have preferred to expend in preparing this material. I note, also, that you request a "very short statement" and I have, therefore, condensed my comments to the point that they are pretty much generalities. I am well aware that to put any one of these general suggestions into force would require very careful consideration of innumerable details.

If my comments arouse any interest for you or any other member of your committee, I assure you that I would be only too happy to expand upon them either in writing or in person. I would be happy to meet with you or any member of your committee at any time you suggest.

In order that you may have some background facts on which you can weigh the propriety and validity of my comments, I am appending herewith a very brief résumé of my professional and business career.

Very truly yours,

WILLIAM F. TALBOT, *Vice President.*

Presented herewith are four considerations which the writer believes are of vital importance to the preservation of a competent, effective and economical program of defense research.

1. Establishment by the user arms of clear-cut objectives for the programs of defense research, delineated in such terms that the statement of objectives does not unduly restrict the research approach. Once such objectives are established, strict adherence to the principle that scientific personnel must be free to pursue research and development aimed toward attaining the military objectives without interference as to the methods, techniques, or other strictly scientific matters.

2. Provision for the management and direction of research programs by trained scientists possessing the necessary experience in such management and direction. Within the established budget and objectives, establishment for professional research directors, adequate freedom for management decisions without inter-

ference from military or other bureaucratic sources untrained and inexperienced in research management. Such freedom does not imply irresponsible and indiscriminate expenditure of funds and effort; rather it fixes a thorough responsibility for such directors in respect to both the results of research under their directions and for operations within assigned budgets and objectives. Fixed and direct responsibility is now frequently escaped. Failure and inefficiencies can be excused or go undetected due to the constant tampering with organizations, personnel, methods, techniques, equipment, supplies, and other matters which should lie within the discretion of competent directors. The responsibility for tampering lies with military and other personnel having positions of assigned or presumed authority over research programs but having no record of successful administration of research.

3. Complete overhauling of the established systems of procurement of personnel, equipment and supplies for defense research establishments and for control of research programs. These systems have become thoroughly bogged down in regulations, many of which are superfluous, conflicting, and petty. In many cases the regulations are administered by individuals of low competency, completely unfamiliar with and unsympathetic to research needs. In the main these individuals are completely lacking in the sense of extreme urgency with which our defense program must be pursued. The net result from such regulations and methods of administration has been a frightful and incalculable waste of research expenditures. Far more important, however, has been their debilitating effect on the morale of defense research establishments as vital work is slowed to a snail's pace by forces with which the scientists are powerless to cope. While many competent scientists, understanding the tremendous importance of our defense research programs have stayed on despite discouragements and defeats, many others feeling that their scientific abilities have been wasted have preferred to seek industrial employment. Without reflecting any disparagement on the many competent and patriotic remaining in Government service, one can state unequivocably that the quality of the personnel and the quality of the work in defense research establishments is steadily declining at a time when the exact opposite should be the case.

4. Establishment within the military of a corps of competent, technically trained officer personnel, free from the necessity of reassignment to nontechnical tasks at frequent intervals, and operating under a system which will provide equal opportunity for advancement within such service as for officers holding other assignments such as field duty and troop command. The duty of such officers should be to provide the liaison between military planning and defense research. They should not exercise the function of research direction. On one hand, they should assist in translating military objectives into scientific objectives. On the other, they should interpret the results from defense laboratories into terms understandable by strategic planners and into actual gear and hardware usable by troops in the field. These tasks require tact, imagination, profound skill in personnel relationships and a broad thorough understanding of science and engineering. These tasks cannot be successfully assigned to line officers as a temporary relief from other military duties while facing momentary reassignment to other unrelated duties.

PASADENA, CALIF., *July 17, 1954.*

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Committee on Government Operations,
House of Representatives, Washington, D. C.

DEAR MR. RIEHLMAN: Your letter of July 8 requests that I send your committee a short statement of what I consider to be the most important problems confronting our military research and development program today.

In my opinion the basic problem is to provide better leadership. The brilliant leaders under whom we produced the atomic bomb, influence fuses, and radar have been replaced by professional military men.

The military have been authorized by the Congress to build magnificent laboratories, and to place large contracts with commercial organizations. Since they are required to account minutely for the monies they have been given for this purpose, officers have been given the positions of major responsibility. There has not been established an adequate chain of scientific and engineering authority capable of continuous professional planning, supervision and review of the work.

The present active demand for men with scientific and engineering training in industry (greatly influenced by military contracts), and current growth in educa-

tional institutions are strong competitors against a military organization. Men who develop the skills and are possessed of the personal qualifications for leadership are reluctant to enter or remain in positions subordinate to men trained for military leadership. It is difficult to see how this problem can be resolved, since the scientist must always question and examine, while the military holds obedience and the welfare of his organization to be above all personal considerations

There are many specific problems that arise out of the basic mismatch of the present distribution of responsibility. I shall be very glad to discuss those with which I am familiar if you so desire and time is available.

Very truly yours,

A. H. WARNER.

SOUTHWEST RESEARCH INSTITUTE,
San Antonio, Tex., July 15, 1954.

Mr. R WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Committee on Government Operations.
House of Representatives, Washington, D. C.

DEAR MR. RIEHLMAN: Thank you for your letter of July 8 requesting a short statement from me of what I consider to be the most important problems confronting our military research and development program today. My answer will be based upon my experience of 3 years as an officer at the Ballistics Research Laboratory, Aberdeen Proving Grounds, Md., 7 years with the civil service at the Naval Ordnance Test Station, Inyokern, Calif., and 1 year in the nonprofit Southwest Research Institute.

Our present system of military research and development depends on plans and budgets submitted by the bureaus of the three services, and these estimates and plans are based to a greater or lesser degree upon the recommendations of individual arsenals, bases, and stations doing research and development work. In nearly all cases contracts with private enterprises for important research and development work are monitored by Government personnel. In this general framework I feel the three major problems today are first the lack or real integration of research and development among the several services; second, the conflict between military and civilian personnel in control of technical work; and third, the overdependence on rules and regulations in the present civil-service system which discourages the most competent technical people.

With regard to the integration of the services, each service, the Army, the Navy, or the Air Force operates its own clearance activities, its own system of control of property and purchasing, and its own system of control of research and development planning and budgeting. Closely related is the rivalry between the military of these three seryices and the lack of appreciation of these military personnel of the work of the other services. In actual practice one finds very real barriers between direct interchange of technical information on problems of common interest between technical civilian personnel of the three services. An example of how this can be overcome exists in the solid propellant information agency of the applied physics laboratory at the Johns Hopkins University. Under the auspices of this activity a list of both military and civilian activities doing solid propellant research for the Army, Navy, and Air Force is maintained whereby the activities on this list can exchange technical information of a classified nature directly without clearing such information first. The importance of this can be realized if one recognizes that normally a request for information from a Navy base by an arsenal of the Army would have to go to Army Ordnance in Washington thence to the Bureau of Ordnance and thence to the particular base of the Navy involved. It is evident to me since I left civil service and am working at a nonprofit research institute that this problem of obtaining military technical information is even more difficult for individual contractors who have little understanding of the operation of the various bureaus.

I would feel that we need basically one research and development category of technical personnel who are adequately cleared by all three services and can exchange directly technical information as required without continuous scrutiny by administrative people whose sole concern is to avoid embarrassment either real or fancied. Closely related to this would be the establishment of common system for ownership of specialized technical equipment so that such equipment could be transferred between facilities and contractors as required without such elaborate regulations as now exist or the necessity of transferring of funds in each case between the services.

Turning now to the second point, I have been fortunate to have observed the operation of such laboratories as the Naval Ordnance Test Station, and Naval

Ordnance Laboratory, the Ballistics Research Laboratories, Picatinny Arsenal, and the Naval Powder Factory in sufficient detail to see what can be done when there is achieved a proper relationship between military and civilian control of technical programs as well as the serious damage which can be created through the rotation of officers irrespective of the qualities for the particular assignment. Experiences which I have had personally and discussions which I have had with people much more competent than myself in the administration of technical work in research and development have convinced me that this is an area in which people are clearly not replaceable on a 1-to-1 basis without very careful selection and that the delicate balance and morale of an entire organization is strongly affected by the individual personalities of the administrative people. My own recollections of the Naval Ordnance Test Station convince me what a strong role the commanding officer in an activity plays in determining the morale and inevitably the turnover of technical people not to mention the difficulties in the technical programs which arise through unwarranted interference. I have known some highly gifted officers who were respected on an equal basis by the most competent of technical personnel and I have seen these same officers replaced by people who had little technical background and who were inept in their handling of delicate administrative problems. I feel that the solution can come through the development of a trained corps of technical career men in perhaps a special civil-service system who have complete control of the technical program under the broad direction of the civilian Secretaries of the Army, Navy, and Air Force. These men should not be dependent upon the present complicated job description system of civil service but should be career men and should be paid salaries reasonably commensurate with living standards befitting their role in the organization.

Finally, with regard to the civil-service system, the present rules and regulations, such as the Naval Civilian Personnel Instructions, have gone to such lengths to protect the individual employee that they place a tremendous burden upon the technical administrator and encourage rather forcibly the most competent of such administrators to leave the service and go to industry. The satisfactions of the administrator are inextricably tied up with the results which he can see from his work and when his hands become so tied that he is spending nearly all of his time combating the regulations in order to get the job done, then he will inevitably be strongly attracted to a reasonable offer from an industrial organization.

Perhaps two examples of the type of thing which discourages the technical man may be pertinent. The first is that I have seen cases where the effective prosecution of an action to promote a really good man would take as much as 80 hours of intensive work over a period of 1 year by high-level technical administrators, and even greater amounts of time would be required to get rid of obviously incompetent people. Another example is that in my own case I have had occasions when I would have carried out expenditures of the order of $10,000 with no other approval than my own and at the same time have to submit a certified statement by a taxicab driver that a particular trip cost more than $1 (since changed to $3) before I could be reimbursed for the full fare. I would feel that the present civil-service system should be overhauled so that the major emphasis of the system is to encourage initiative and to provide the civil servant with such support in a financial and administrative sense that he can feel that he is the equal of the corresponding people that he deals with outside of the Government. Perhaps this can be solved by the creation as I suggest above of a special civil service corps of highly competent and respected technical personnel. This would be analogous to the British system in many regards.

I hope that the above information is not too lengthy for your purposes. I would be very happy to enlarge on any of these points as you desire and would be most happy on one of my visits to Washington to see you personally and discuss further any of these items which you may wish to consider. I have felt for a long time that it is in our military research and development that we must carry out those developments which support our diplomatic program and we must prosecute this program with expedition because I feel that we are fighting the war with Russia at this very moment. I have felt myself that in developing a program here at Southwest Research Institute of combined military and commercial uses of explosives and propellants that I may be making a more substantial contribution in the long run to military research and development than was possible by me at the Naval Ordnance Test Station.

Sincerely yours,

JAMES H. WIEGAND,
Assistant Chairman, Department of Chemistry and Chemical Engineering.

STANDARD OIL CO. (INDIANA),
Chicago, Ill., June 15, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
House Committee on Government Operations,
House Office Building, Washington, D. C.

DEAR MR. RIEHLMAN: Replying to your letter of May 27, I will give you my offhand answers to the questions you raise. My general feeling is that the gradual evolution in the handling of these activities has been difficult, but that the present setup is resonably good. Answering the specific questions:

(1) While there are inherent characteristics of military organization which tend to hamper an effective program of scientific research and development, I think the military are making real progress in understanding and overcoming these difficulties, especially as they get more and more technically trained men in the higher ranks. I think they appreciate the fact that rigid military discipline does not work well if an attempt is made to apply it to research personnel. Independent thinking and varied lines of approach are essential to proper conduct of research.

(2) It is difficult to obtain and retain the services of highly qualified civilian scientific and technical personnel in a strictly military organization. I think contracting out much of the work, particularly that of a basic nature, is the best answer.

(3) I doubt the desirability of establishing a civilian organization to administer the military research and development programs. Even though the research might be done somewhat more efficiently, you would increase the difficulty of getting the military to really understand the new weapons, take pride in them, and get back of them. There is civilian guidance at the very top, civilian advisory committees on most of the major projects, and civilian competition in some of the fields of research. I believe a balanced approach is better than either a strictly military or a strictly civilian one.

(4) I think my answers to the above question pretty well cover this as well.

(5) I think the Department of Defense should contract with nongovernmental institutions for most of their basic research and for those development programs where industrial experience and background is more important than military experience and background. On the other hand, there are situations in which a military organization has an advantage, such as application testing and instances where there is extreme danger. I do not think that universities in general are a good place to carry out the applied type of research.

I doubt if I have enough to contribute to justify my testifying before your subcommittee, though I shall be in Washington part of the day on July 15.

I think the Department of Defense has in Dr. Quarles a man whose judgment on all these matters is excellent, and who is more familiar than I with the details. One of his close associates, Dr. D. P. Barnard, is "on loan" from us and he would also be in a good position to comment on some of these questions.

In closing, I might just comment on two points not directly covered by your questions. First, I believe there is still inadequate communication between the different services and some duplication of effort on matters like the development of guided missiles, propellants, etc. I should also like to emphasize that applied research in either a military or an industrial organization has two functions: (1) To develop the best possible process or end product, and (2) to educate and to be educated by the organization for which the work is being done. Taking research away from the military or moving it away from an industrial plant may have some advantages, but it does lose the value of the two-way educational process to which I refer.

Very truly yours,

ROBERT E. WILSON.

THE OHIO STATE UNIVERSITY RESEARCH FOUNDATION,
Columbus, Ohio, July 15, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
Committee on Government Operations, House of Representatives,
House Office Building, Washington, D. C.

DEAR SIR: Replying to your letter of the 8th inviting comment on important problems facing the military research and development program today, I am happy to make a short statement for whatever it may be worth to you. Doubtless you have accumulated a considerable file of information during the course of

your inquiry, and it seems to me very unlikely that I can bring out any new points or add much enlightenment under the circumstances and in view of the limitations on your time and the brevity of the statement which I am to make. However, I did have some 10 years of association with a military research and development program as an Army officer and later as a civil-service employee. More recently I have had a look at it from the viewpoint of the university engaged in contract research for the military. Therefore, I do have some background of information and can speak feelingly on certain points.

First let me say I feel there can be no doubt that a strong and continuing program of research and development is vital for the defense effort. I assume there is no difference of opinion on this point in the minds of any informed people. Further, let me say that in my opinion the research dollar, properly invested, yields returns as great as or greater than any other dollar which the Government expends. This is not to say, however, that money cannot be wasted in poorly conceived and poorly administered research and development programs.

Another well-understood point, but one that bears repetition, is the necessarily long time lag between the initiation of a research project and the end product on the shelf and ready for military use. This fact sets a very high premium on vision in planning ahead and on steadfastness in pursuing carefully selected goals. I would say that this is one of the major problems facing any research and development program, whether it be military or otherwise, that looks to an ultimate payoff in a material sense.

It is well understood by all informed people that the military research and development program is carried out in part in Government laboratories and in part by industry and by nonprofit institutions. This partition of effort is convenient and desirable in the interests of all concerned. There is of course some problem in the matter of policy as to which projects or what types of research should be allocated to Government laboratories as contrasted to non-Government; but lines of cleavage are reasonably obvious and logical. It seems clear to me that Government laboratories will always be in the picture to carry out much of the work having exclusive military application or having a high security classification, or necessarily involving military personnel in testing and the like; also programs which require combinations of talents and facilities not ordinarily to be found in industry or at nonprofit institutions.

For any research program, under whatever auspices, the research scientist or engineer is the sine qua non, the nucleus around which all planning must be formulated. One can build laboratories and procure equipment ad infinitum, but without the trained mind and skilled hand of the key investigator nothing worth while will come of them. Again, this is a pretty well accepted truism but cannot be overemphasized, especially in connection with the operation of Government laboratories. I would say that this is the No. 1 problem for any military research and development program: to acquire and maintain in an adequate state of morale and productivity the requisite research staff. Your committee, I am sure, is only too keenly aware of the serious and at times irremediable damage which can result in cases of maladministration, unenlightened and unsympathetic supervision, overzealous and misguided investigations, unwarranted attacks on Government employees as a class, unnecessary curtailment of academic freedom in the best sense of the term, and unenlightened meddling in technical matters on the part of administrators who have little or no technical background. In short, it is vital to maintain the morale, the dignity, prestige, and relative freedom professionally of the scientist and his technical assistants in Government employ, if we are to have a sound and productive research and development program. This will be a perennial problem—not one that can be solved today and forgotten tomorrow.

Instability of policy and fluctuations in the level of financial support of particular programs are perennial headaches for anyone administering a military research and development program. Research and development plans should be based on a timetable of 5 or 10 year increments, and not subject to the vicissitudes of politics and the perils and uncertainties of annual appropriations made late in the fiscal year, or frequently well after the new fiscal year has begun. I feel that we have never really faced up to this far-reaching problem. A critical review and realinement of policies and mechanisms in the legislative and executive branches in respect to research and development matters are indicated, in my opinion. Otherwise, our research and development programs will never realize their full or desirable potential. No doubt we will manage somehow, as we have in the past, by grace of good fortune and our tremendous resources, but only with needless inefficiency and excessive cost.

Most of the foregoing has concerned the Government's intramural research and development activities. As to research and development carried out by industry and at universities and other nonprofit institutions, some of the same problems obtain, but they are certainly much less acute in most cases. From the university's point of view, I would say that there still appears to be need for much more unification among the military services and branches as to contract policies and procedures. Surely it is inefficient and more costly for any particular institution to deal concurrently with several services and branches through a variety of channels and subject to different policies and practices. There still needs to be better appreciation of the fact that there are natural and inherent differences between straight procurement operation and contracting for research services. It should be better understood, too, that universities should not and cannot be held to industrial policies and practices in respect to many aspects of contract research. It would be in the interests of the Government and universities if more stability could be afforded Government research projects carried out at universities, and more freedom of publication and so forth were provided. This follows from the nature of universities, and the fact that the research which they carry out is and must be more basic, long range, and without security classication in most instances.

I hope that the above remarks may be of some assistance and interest to you.

Sincerely yours,

ORAM C. WOOLPERT, M. D.
Executive Director.

UNITED STATES NAVAL ORDNANCE TEST STATION, INYOKERN,
China Lake, Calif., July 29, 1954.

Hon. R. WALTER RIEHLMAN,
Chairman, Military Operations Subcommittee,
House of Representatives, Washington, D. C.

DEAR Mr. RIEHLMAN: A personal friend and a member of the Naval Ordnance Test Station Advisory Board, Dr. C. C. Lauritsen, has shown me a copy of your letter to him requesting his opinion relative to certain aspects of operating a research and development laboratory, and suggested that I, as commander of this establishment, comment to you directly.

As you probably know, the Naval Ordnance Test Station is an activity of the Bureau of Ordnance, consisting of approximately 4,000 civilian scientific and engineering personnel and approximately 1,300 military personnel.

The following is the mission of the Naval Ordnance Test Station:

Support the research, design, development, production, test and experimental projects and programs of the Bureau of Ordnance and those of other ordnance establishments and private contractors, as authorized and directed by the Bureau of Ordnance. In implementation of the above:

(1) Conduct research for the continued improvement of naval ordnance weapons and weapon systems, principally in the fields of science supporting rockets, guided missiles, air-launched torpedoes and aircraft fire control;

(2) Conduct feasibility studies of proposed new or improved weapons or weapon systems within assigned fields of cognizance as a basis for sound recommendations on future development;

(3) Develop the design of new devices, components and weapons within assigned fields of cognizance, evaluating designs and testing models as necessary to insure that the end product will satisfy all essential and prescribed operational, product and production requirements;

(4) Develop, produce, procure, evaluate or test ordnance devices, components, processes, weapons, or weapon systems within assigned fields of cognizance and provide technical consulting services pertaining thereto, for Ordnance Establishments, contractors of the Bureau of Ordnance, the Department of Defense, and/or agencies of the United States Government, as authorized and directed by the Bureau of Ordnance.

As authorized and directed by the Bureau of Ordnance:

(1) Maintain and operate such ranges, launchers, and instrumentation necessary for the accomplishment of assigned tasks;

(2) Conduct basic training in the maintenance and use of new ordnance equipment;

(3) Maintain and operate laboratory facilities for the examination, development, surveillance, test and standardization of materials and techniques for ordnance purposes.

Maintain under proper surveillance, the ammunition and explosives in store. Dispose of unserviceable and/or dangerous ammunition and explosives, from whatever sources received, in accordance with current directives.

The basic policy of this station is that the technical activities of the station will be conducted and directed by professional civilian scientific and engineering personnel. To the end that service operational knowledge and requirements will be continuously known and utilized throughout weapon and system development, qualified military personnel are assigned on a participating basis.

In conforming with this policy, the position of technical director has been established to whom is delegated control of the research, development, test, and training activities, including methods of conducting these activities. The technical director is responsible for conducting a comprehensive technical program designed to maintain balanced and coordinated research and effective development, including production and process development, in the fields of weapons systems over which this station has cognizance and for the technical achievements resulting therefrom.

The present technical director, Dr. William B. McLean, has given me permission to enclose herewith, copies of letters addressed to the Chief of the Bureau of Ordnance by Dr. McLean in which he comments on the type of organization existent at this station. I concur fully in Dr. McLean's comments and feel that they might be of interest to you.

Sincerely,

DAVID B. YOUNG,
Captain, USN, Commander.

UNITED STATES ORDNANCE TEST STATION, INYOKERN,
China Lake, Calif., April 2, 1954.

DEAR ADMIRAL SCHOEFFEL: I am very happy to be asked about my opinions concerning the organization of the United States Naval Ordnance Test Station. A comparison of the advantages and disadvantages in this organization with those of other types of organization for the same purpose leads me to the conclusion that we will be able to accomplish the development of military equipment in the most efficient manner. I would be glad to discuss the relative merits of various organizations at any time but hope that it will suffice for the present to merely list what I consider to be the chief strong points of the Naval Ordnance Test Station. These are:

(1) Military and scientific viewpoints are combined here in one organization and directed to the common objective of inventing and improving weapons for the fleet. The best weapons will require a mixture of both viewpoints. Close working relationships with common goals should facilitate this mixture.

(2) The military personnel assigned to the Naval Ordnance Test Station provide a function similar to that existing in the engineering planning and sales group of a commercial organization. They represent the user of the products being developed by the station; as such, they can present the reasons for military requirements in a manner most likely to achieve better developments.

(3) The experience gained by scientific personnel in carrying out tests, assisted by military personnel, provides a background which is important in establishing the judgment necessary to evaluate the various factors effecting a final design.

(4) Experience of military personnel in development work will establish the knowledge of development methods and problems needed in order to gain the rapid acceptance of new military equipment by the fleet.

(5) A continuous influx of new personalities into an organization helps promote new ideas and will be beneficial provided the stability of the station is maintained by a strong, permanent staff.

The Technical Director of the Naval Ordnance Test Station, by reason of being the first responsible officer in this governmental organization who expects to have permanent tenure, has a responsibility to insure that the work of the station is so organized that it will yield the best return for the country and the Navy from a long-range standpoint. This type of responsibility is a unique occurrence found only in governmental organizations since it represents a duty not shared fully by higher levels in the organization. The higher levels are, to a large extent, relieved of this duty by reason of the definite limits on their length of tenure in office (tour of duty, political appointment, and election). Any organization, which can recognize the needs of the Technical Director to discharge this responsibility and allows him to accomplish it to the best of his ability, will operate satisfactorily. It can be expected that conflicts will arise where desires for short-range progress

compete for attention with longer-range plans. These conflicts are of an essential nature and I believe that their resolution by the kind of balance which can be achieved at the Naval Ordnance Test Station will result in more progress than would be possible if either objective were suppressed. This balance of power, strongly and ably supporting both objectives, will prevent this organization from failing by either the route of concentration wholly on long range ideas which are never brought to completion, or by the route of exclusive attention to engineering and tests of products which will yield only small immediate improvements. The present organization is designed to accomplish this balance.

In considering your question concerning the position of the Technical Director, I find that I believe an organization will function most effectively if all lines for achieving action are kept as short as possible. An organizational structure should never be set up merely to achieve communication. Effective action in development work can result only if communication proceeds regardless of organizational channels. I have never found it possible to accomplish action more effectively by a direct order than by a request for help and a discussion of the needs. For these reasons, I believe that the decision you made, with regard to the organization of the Naval Ordnance Test Station, will result in maximum accomplishment by that Station.

Enclosed is a copy of my Form 57, taken from the personnel files here at NOTS, with an additional paragraph to bring it up to date.

I will take action to fill out a questionnaire from American Men of Science, which up to now I have failed to do.

If a personal discussion of any of these matters would be desirable, please advise me.

Respectfully,

WILLIAM B. MCLEAN,
Head, Aviation Ordnance Department.

UNITED STATES NAVAL ORDNANCE TEST STATION, INYOKERN,
China Lake, Calif., March 19, 1954.

Rear Adm. M. F. SCHOEFFEL, United States Navy,
Chief, Bureau of Ordnance,
Navy Department, Washington 25, D. C.

DEAR ADMIRAL SCHOEFFEL: I consider it a great privilege to accept the position as Technical Director of the United States Naval Ordnance Test Station because I believe:

(1) This station represents an important and perhaps critical attempt to achieve the utilization of scientific techniques in the construction of weapons for the defense of our country.

(2) The Bureau of Ordnance, in establishing NOTS, wisely provided in one location, all of the features required to carry a development from the idea stage through acceptance and use by the fleet. At the same time, it provided sufficient management freedoms to attract competent people, to successfully design new weapons and to effectively prosecute new ideas through broad tasks and exploratory and foundational funds. It is important that the integration of scientific knowledge into military science, achieved by this course of action, be continued.

(3) A team such as that existing at NOTS, which consists of both military and scientific personnel, can accomplish the successful development of weapons more effectively than either group working independently, in spite of the differences in training and outlook which superficially makes such a team difficult to operate. The accomplishment of this teamwork has shown such a strong improvement during the 9 years I have been at NOTS that I believe it is very close to making its strength apparent to all.

(4) This laboratory and the other Naval Ordnance laboratories represent an accumulation of scientific talent and experience within the Navy which is vitally needed by the Bureau of Ordnance to assist in planning a program to successfully discharge its responsibility of delivering weapons to the fleet.

(5) The experienced development personnel available in the Bureau of Ordnance laboratories are an outstanding source of trained assistance for use by the Bureau in directing commercial firms on projects whose prime utilization is in military equipment. This ability needs to be maintained and developed.

I deeply appreciate your trust that I can effectively promote the activities of this station.

Respectfully,

WM. B. MCLEAN,
Head, Aviation Ordnance Department.

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